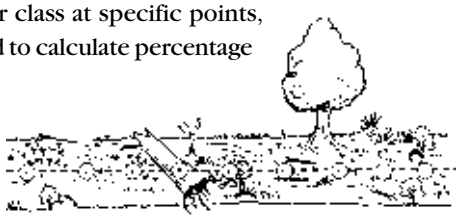
Point intercept

An objective and commonly used method. Ground cover class at specific points, normally along a transect line, is recorded. This is then used to calculate percentage in different types of cover (for example, litter, vegetation, soil, rock, etc) from the total number of points assessed (*see* Figure 16, p.54).



For more details of 'point intercept' see Figure 16 p. 54.

Comments

Can provide a reliable, objective estimate

References

'Point intercept – for forest ground cover assessment', p.53

BIRD DISTRIBUTION

The indicator

What is it?

The distribution of important or rare bird species.

Discussion

As with the assessment of rare plant species, this indicator becomes important where a particular species is localised or present as small patches in particular locations (for example whio, blue duck). In these situations its presence at certain locations becomes more important because density across the whole area may be too low to measure.

Maintenance of the species at particular locations, and increases or decreases in the number of locations where the species is present can be monitored.

Some key issues

- Intensity (area covered and effort) of searching needs to be similar to make valid comparisons of changes in distribution over time, or between areas.
- What scale should distribution be assessed at? This needs to be determined depending on factors such as how large the area is where the species occurs, and how precisely you need to know individual locations.

Measurement methods

The issues with the use of bird indicators identified under 'Bird abundance' (p. 148) need to be taken into account when examining bird distributions. Some possible methods used in New Zealand are set out below.

Mapping locations of uncommon species

The locations of sightings of species of interest are recorded and mapped at suitable scale, such as on NZMS 260 series, 1:50,000 maps. 'Distribution of key species/uncommon species', p.131

FIGURE 42: Birds form an important part of the forest ecosystem and can perform roles such as seed dispersal.

PHOTOS: DOC

identifies some points to consider. Relevant information on individual sightings is recorded where possible, such as numbers of individuals seen, habitat, sex, juvenile or adult.

Comments	References
● Provides a useful first reference	Hay et al 1989
● When comparing distribution, intensity of searching must be similar	

Mapping presence within grid squares


The area of a set map grid square is traversed, and the presence of species identified within the grid squares is recorded. During the 1970s this approach was undertaken across New Zealand using 10,000 yard grid squares.This culminated in the publication in 1985 of maps of the distribution of 118 land bird species (Bull et al 1985).

Comments	References
● Publication of historic national data mean subsequent comparisons are possible	Hay et al 1989 Bull et al 1985
● It is important that intensity of searching, and observer skill are similar when comparing distribution to look at change	

BIRD ABUNDANCE

The indicator

What is it?

The relative or absolute abundance of a particular bird species or group of bird species.

Discussion

Information on birds can provide valuable indicators. Native bird species are consumers of various primary production from the forest, whether it is fruit and nectar bearing species (*see* Appendix 3) or invertebrates that in turn feed on the forest. Because of this the abundance of birds may provide an indication of the wider condition of the forest such as the maintenance of a diversity of fruiting and flowering species, and maintenance of abundant vegetative growth and litter fall for invertebrates.

However, as discussed below in 'Some key issues' there are considerable difficulties in getting reliable estimates of changes in bird abundance. Reliable estimates can be achieved, but they require careful design of monitoring and careful assessment in the field.

Some key issues

Monitoring of forest birds can be difficult. It requires good bird identification skills, both from sightings and calls, and these skills take time to develop.There can be considerable error introduced into bird monitoring from different observers having differing abilities in bird identification. Different bird species vary greatly in their habits, and in how conspicuous (lively and noisy) they are and, consequently, in how easy they are to count. Some bird species, move around during the year following seasonal food sources. Most birds are more active and vocal during breeding, and are quiet and reclusive during the post-breeding moult. Differences in activity also occur with changing weather and time of day.These factors need to be considered in any bird monitoring.

Some useful pointers when considering bird monitoring are:

- Learn or improve your bird identification. The best way to do this is to spend time in the forest with a pair of binoculars, trying to locate and identify all the birds you hear or see.
- Possibly concentrate on key species you know you can identify for example, kereru, tui/bellbird.
- Collect data over a period, for example, one month, not just days, and measure at the same time each year.
- Collect data in the same weather conditions – ideally fine and still.
- Assess when birds are most conspicuous – usually in the breeding season between August and November.
- Use methods that minimise identification based on calls alone.

Measurement methods

Territory mapping

This involves intensive study of an area, sometimes including marking of individual birds to allow identification of territories for territorial species. Estimates of the density of birds can then be made, and presence or absence of known birds from territories monitored. This is a time consuming method that requires considerable skill. It is normally used for detailed scientific studies.

Comments

- Very time consuming if useful results are to be obtained

References

O'Donnell 1996

Capture rate in mist netting

Some studies (Brockie 1992) have used catch rates in mist nets to provide some indication of relative abundance. This method is limited to skilled individuals with approval for mist netting. It is time consuming to install and monitor nets, but it allows collection of other population data in detailed scientific studies.

Comments

- Requires specialist skills and is time consuming.
- Nets can catch selectively for example, those species low in the forest.

References

Brockie 1992

Five-minute count

This is the most widely used method in New Zealand. All birds seen or heard over a five-minute period at a fixed listening point are recorded. Big differences are likely with seasonal changes in 'conspicuousness' of different species. It does not assess a fixed area.

Comments

- Requires good birdcall identification skills
- Subject to all usual bird monitoring variation

References

Hay et al 1989
Elliott 1998
Dawson & Bull 1975
Cassey & Craig 1998

Distance sampling


This method involves assessing distance to each bird observed on a transect or at a point. This allows calculation of bird density, subject to various assumptions. This is potentially a useful technique but likely to involve considerable difficulty in estimating distances, particularly if there are many observations.

Comments

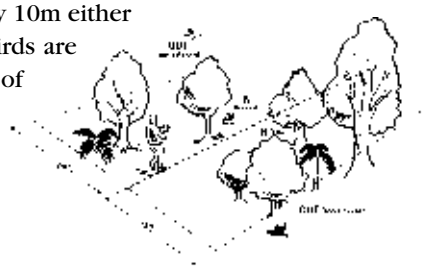
- Has advantage of providing a measure of actual density
- Estimation of distances to birds can be difficult

References

Cassey & Craig 1998
Cassey et al 1998
Buckland et al 1993

Fixed area – 'slow walk' transects


This is something of a hybrid technique. It involves slowly walking along a transect and only recording birds that are present within a set distance, usually 10m either side of the transect (*see* Figure 21). Because only nearby birds are included, this technique results in a much higher proportion of birds identified by sight. It is probably less affected by changes in conspicuousness. It also provides some measure of density because counts are area related.



For more details of the 'slow walk' transect see Figure 20 p. 68-71.

Comments

- Greater proportion of birds identified by sight, so lower call identification skills may be required
- Some indication of density provided

References

'Forest bird slow walk transects', p.68
Lovegrove 1988
O'Donnell 1996

BIRD SPECIES COMPOSITION AND DIVERSITY

The indicator

What is it?

Number of bird species and their relative abundance.

Discussion

This uses data gathered under the abundance methods. Species generally vary in their conspicuousness and likelihood of being sampled under these methods. Consequently, each species is effectively measured on its own scale (Dawson 1981). This means using data gathered when assessing abundance may give an incorrect indication of species diversity and composition. The more time and effort that has gone into abundance measurement, the less significant this problem will be because when large amounts of time and effort are expended, even relatively rare or inconspicuous species will be recorded.

Use of this indicator should be kept simple, used sparingly, and with the limitations discussed above well understood. With this in mind, consideration of the total number of species and the number of indigenous compared with exotic species can be useful.

Some key issues

- See general issues, above.

Measurement methods

Uses data gathered under assessment of abundance, and also possibly in distribution studies. Simple calculations can be undertaken to identify the total number of species, and the proportion of species in different groups (for example, exotic and indigenous species). Diversity indices, such as the Shannon-Weaver Index (*see* 'Species composition and diversity', p.124), can also be used.

BIRD POPULATION STRUCTURE

The indicator

What is it?

Various features associated with individual bird populations such as relative numbers of juveniles and adults, sex ratios and fledging rates.

Discussion

This indicator provides specific information about individual species in a certain area. It is normally used when examining specific issues for the management of rare or endangered species.

This approach involves monitoring individual birds to examine things such as movements, breeding success and mortality. Individual birds are identified by banding, tagging, attaching radio transmitters, or occasionally by distinctive natural markings.

Some key issues

- This indicator generally requires considerable skill and resources to measure.
- Avoiding disturbance to the species involved requires skilled and experienced fieldworkers.

Measurement methods

These methods are difficult and require a high level of skill. They are generally suited to detailed research studies involving skilled people.

Detailed population studies


Identification of breeding pairs, nests, and monitoring of reproductive success is a useful technique, but requires large amounts of time and skilled people (Powlesland 1997). It is suited to studies on key populations of important species, or where specific impacts are to be examined.

Comments

- Very time-consuming and requires skilled people.

References

Hay et al 1989
Powlesland 1997

Nesting success


Similar to the above method, this approach concentrates on the proportion of nests to successfully produce young, and the proportion of nests to fail. It requires locating nests, and then regularly observing it to identify if young are produced, or if the nest is preyed on. The Mayfield method (Mayfield 1961, Mayfield 1975) should be used.

Comments

- Time-consuming and requires skilled people to get good results and avoid disturbance of birds

References

Clout et al 1995
Mayfield 1961
Mayfield 1975
Johnson 1979

LARGE VERTEBRATE PEST DISTRIBUTION

The indicator

What is it?

The distribution of particular pest species, for example, deer, goats or pigs.

Discussion

As with plant pests, the distribution of animal pests is an important indicator. If animal pests are new arrivals to an area, they will potentially spread. Obtaining up-to-date information on distribution of animal pests allows managers to identify new introductions, and identify sites where eradication may be possible.

Ongoing changes in the distribution of an animal species, and their spread into new areas can be assessed.

Some key issues

The key issues are similar to those for other indicators involving assessment of distribution:

- Intensity (area covered and effort) of searching needs to be similar to make valid comparisons of changes in distribution over time, or between areas.
- What scale should distribution be assessed at? This needs to be determined depending on factors such as how large an area the species is spread over, and how precisely you need to know individual locations.
- If species are widespread throughout the area, examining distribution may be of little use.

Measurement methods

As with monitoring the distribution of bird species, distribution can be identified by mapping individual records of animals, or by identifying if they are present in particular 'grid squares' following a traverse of the area.

Mapping of the distribution of populations is important for comparison with other ecological data. Standardisation of the scale of mapping is required. Mapping on 1:50,000 scale topographical maps is often the most appropriate.

In some situations, such as when the control is undertaken by forest managers or licensed commercial operators, records of the individual locations of hunting kills and observations can be maintained. This can provide indications of areas of animal activity and abundance.

Mapping data in an electronic GIS (Geographic Information System) format is useful for managers of large forest areas.

PHOTOS: DOC

FIGURE 43: Large vertebrate pests such as deer and goats can have major impact on forest ecosystems.

LARGE VERTEBRATE PEST ABUNDANCE

The indicator

What is it?

The relative, or absolute abundance of a particular animal pest species or group of pest species.

Discussion

Information on the abundance of animal pest species is important. Certain monitoring questions may mean you need to compare changes in browsing animal abundance to measures of vegetation condition, such as understorey density to examine how animal populations may be affecting vegetation.

The abundance of pest animals is important when examining the operational success of animal control operations.

Some key issues

- Make sure the pest species assessed is relevant to your monitoring question.
- If you are monitoring abundance, the animal needs to be common enough so you can readily locate it. Otherwise, it may be better to assess distribution.

Measurement methods

Faecal pellet counts

This method has been widely used for some time in New Zealand, particularly in studying deer populations.The method basically relies on a relationship between the amount of faecal pellets in an area and the size of animal populations. However, the amount of faecal pellets present can also be affected by other factors, particularly weather.Wet weather results in the faster decay of pellets so fewer pellets would be present. Conversely, dry weather reduces the rate of decay so more pellets would be present.There are ways of adjusting for these (Baddeley 1985), but they mean this method can be unreliable if you are trying to accurately examine change over time.

The assessment and results presented generally have two forms, which are often undertaken together.

- *Density:* The number of faecal pellet groups in small plots along a transect are counted.This is used to calculate the density (pellet groups per hectare) of pellet groups. As discussed above, the method can be affected by weather by increasing or decreasing the decay rates of pellets.To get useful estimates of pellet density, considerable effort can be required.Animal density estimates can be calculated, but rely on broad assumptions on defecation rate.
- *Frequency:* A simplified and commonly used method is to record just the presence of faecal pellet groups within a plot. Percentage frequency is then calculated for the survey to provide a measure of relative abundance that can be monitored over time.This has the same drawbacks as other frequency-based measures which are not very effective at picking up small changes in abundance.

Comments

- Needs to be treated with care, can produce unreliable results

References

Baddeley 1985

Hunter effort


This generally involves recording the number of animals killed per hunting day as a measure of relative abundance. It can be a useful method for monitoring of deer, goat and pig numbers. It can be enhanced to record animals seen and also hours hunted per day to increase reliability and information.

Records of helicopter hunting and animals killed per machine hour also provide valuable hunter effort information. Records of numbers seen can be recorded in situations where kills are not appropriate. These hunter effort methods provide an index of abundance. They can be affected by hunter skill and exposure of animals to hunting pressure.

Recreational hunter returns can be used to provide this information. There is often considerable concern about the accuracy of such returns because they rely on hunter honesty. Improvements to such systems can be achieved by concentrating record keeping on known reputable hunters, and phone and mail follow-up surveys.

Comments

- Can provide useful indications of abundance
- Difficult to pick up small changes
- Impacted by differences in hunter skill, and exposure of animals to hunting pressure

References

Henderson & Nugent 1989

Handford 1992

Hunted density


This method has been used particularly on goats. It involves setting up small hunting plots of perhaps 10-20ha and then carefully and thoroughly hunting the animals to extinction, over a short period, in this area. An estimate of density is obtained from the number of animals killed and the size of the area hunted.

Comments

- Requires careful planning and supervision to get meaningful results
- Potentially simple and useful method if undertaken carefully

Population model estimates


If there is some information on the trend in population density and the number of animals that are being shot from an area, crude estimates of total population and average population density can be made. This method requires access to information from other studies on the likely rate of population increase for the species.

As an example, if a deer population over an area of 10,000ha of forest has been shown from pellet surveys to have remained fairly stable, and about 150 deer have been shot in the area per annum, then all of the population's natural increase is being removed by hunting. If you assume a natural rate of increase of 30 percent per annum, then the total population would be around 150 x 1/0.3= 500, and the density would be 500/10 = 5 / km^2.

Comments

- Provides a check on the reasonableness of estimates produced from other measures
- Can be refined over time as more information is collected

LARGE VERTEBRATE PEST POPULATION STRUCTURE

The indicator

What is it?

Various features associated with individual animal pest species populations such as relative numbers of juveniles and adults, sex ratios, animal weight and condition.

Discussion

Information on aspects of individual animal pest population structure can provide indications of trends in these populations, and sometimes the relationship of the population with its habitat. For example, the presence of large numbers of juveniles may suggest the population is increasing. An increase in animal body weight may suggest an increase in the amount of food available from the understorey. A decline in bodyweight may suggest increasing competition within a larger population.

Trends within populations can often be complicated by many different factors. Specialist knowledge is often required in interpreting the changes.

Some key issues

- Make sure the feature of the population you are assessing is relevant to your monitoring question.
- Check you have some knowledge or experience of the population features being examined, so you will be able to draw some useful conclusions.

Measurement methods

Key information is usually:

- *Sex.*
- *Age:* on both deer and goats, age can be determined by counting annual rings on a cross section through the incisor teeth.
- *Condition:* where carcasses are extracted, such as in helicopter venison recovery, condition can be determined from carcass weight. The jawbone length in deer has also been used as an index of body size (Henderson & Nugent 1989).

Relationships between age and body size can identify the relative condition of a population.

POSSUM DISTRIBUTION

The indicator

What is it?

The distribution of possum populations within an area.

Discussion

Possums are present in most areas of mainland New Zealand. However, there are areas, particularly in the far north and far south where possums are not yet present or are just entering. Identifying and monitoring this distribution can be important to management. As with large animal pests, obtaining up-to-date information on the distribution of possums in new areas may allow identification of sites where eradication may be possible.

Abundance of possum populations may vary considerably between areas. Monitoring of the distribution of different abundance levels can provide useful information for management and allow comparison with other indicators providing information, such as, impacts on native vegetation.

Some key issues

The key issues are similar to those for other indicators involving assessment of distribution:

- Intensity (area covered and effort) of searching needs to be similar to make valid comparisons of changes in distribution over time, or between areas.
- What scale should distribution be assessed at?
- If possums are very widespread throughout the area, examining distribution may be of little use.

FIGURE 44: The possum is one of the most widespread and destructive forest pests in New Zealand.

PHOTO: DOC

Measurement methods

Distribution can be identified by mapping individual records of animals from trapping or poisoning, or through identifying if they are present in particular 'grid squares' following a traverse or other assessment of the area.

As with other indicators examining distribution, mapping of the distribution is important for comparison with other ecological data. Standardisation of the scale of mapping is required. Mapping on 1:50,000 scale topographical maps is often the most appropriate.

POSSUM ABUNDANCE

The indicator

What is it?

The relative, or absolute abundance of a possums.

Discussion

As a pest that has a great impact on native forests, and on agricultural production through the spread of tuberculosis, information on the abundance of possums in forest ecosystems is crucial.

Monitoring questions often require impacts on native forests, such as changes in canopy condition, to be compared with changes in possum abundance, to examine how possum populations may be affecting vegetation.

Some key issues

- In any areas that possums have recently colonised, or where densities are extremely low, measurement of abundance may be more difficult.

Measurement methods

Faecal pellet counts


This method has been less commonly used in recent times for assessing trends in possum populations. The presence of faecal pellets in small plots along a transect is recorded. This allows a percentage frequency to be calculated for the survey.

As with all pellet survey methods (*see* 'Large vertebrate pest abundance', p.153), this method can be affected by the impacts of weather in increasing or decreasing the decay rates of pellets. To get useful estimates of pellet density, considerable effort can be required. This method provides an index of abundance, not a direct measure.

Comments

- May be an option in some areas, for example, if trap catch cannot be used
- Usual variations associated with pellet counting methods need to be considered

References

Baddeley 1985
Morgan 1990

Trap catch


This method is the main method for assessing the relative density of possums in New Zealand, and it has also been widely used for the assessment of other small mammals such as rats and mice. Trap lines are set in accordance with a protocol (NPCA 2000) and the number of animals

caught per 100 trap nights is used to assess relative population density. Traps are operated for three consecutive fine nights.

Comments	References
● The most widely used method in New Zealand	NPCA 2000
● Established measurement protocols	

Trap to extinction


All the possums within a known area are trapped, and killed or removed over a short period (so no replacement breeding or immigration occurs). This allows estimation of density from the number of possums killed divided by the area trapped. Care must be taken to ensure all possums have actually been removed, and you are not just dealing with a 'trap-shy' population.

Comments	References
● Only practical over small areas because considerable effort is required	Cowan & Waddington 1990
● Simple, and it provides control	

Bait take


This method involves assessment of interference with non-poisoned baits, or monitoring the removal of poisoned baits if control involving fixed bait stations is being undertaken. Records of bait taken from stations can give some indications of changes in possum populations. If high populations are present, a large proportion of bait will be taken, with lower populations a smaller proportion of bait will be taken. This method has been shown to be open to biases (Spurr 1995) when it is run over consecutive nights because the level of interference can increase from night to night as possums remember the location of baits. Adjustments can be made for this (Spurr 1995). It is not suitable when possums are at high numbers because all bait will be removed, making it difficult to compare populations above a certain level. However, it can potentially allow indicative monitoring of change over time on a site, at lower possum numbers. Having baits well spaced and using different random locations on each night may reduce bias.

Comments	References
● Care required to avoid bias	Spurr 1995
● Not effective with very high possum numbers	Waikato Conservation Board 1997

Damage and sign indices


Possums can produce conspicuous signs with bite marks and scratching on tree trunks, browsing of favoured canopy species, taking of fruit, etc. Visual assessment of this can be used to provide a qualitative index of possum numbers. Quantitative measurement of damage on vegetation or larger fruits of species such as tawa is possible and it can provide an index of populations.

However, these assessments can be misleading as indices of possum abundance because they are measuring the impacts rather than the actual population. For example, a large amount of possum browsing in an area may reflect the presence of larger numbers of favoured plant species

that possums have travelled to from a considerable distance. It may not necessarily mean there are high possum numbers throughout the area. A change in the amount of damage on fruit may be affected by the amount of fruit produced in a year as well as possum abundance. If these interactions are taken into account, useful indications of changes in abundance can still be obtained.

Whenever examining changes in impacts on leaves or fruit, take care to separate possum damage from that caused by rodents or insects.

Comments	References
• Care required interpreting the results because this is an indirect measure of abundance which measures impact rather than populations	Payton et al 1999

POSSUM POPULATION STRUCTURE

The indicator

What is it?

Various features associated with individual possum populations such as relative numbers of juveniles and adults, sex ratios, possum weight and condition.

Discussion

As with large pest animals, information on possum population structure can be useful to provide indications of trends in the populations, and sometimes the relationship of the population with its habitat. For example, an increase in animal body fat may suggest an increase in a certain food source such as fruits (Cowan 1990), and a possible subsequent increase in population (Handford 1992). A decline in bodyweight may suggest increasing competition within a larger population.

Again, trends within populations can often be complicated by a influences from many different factors. Specialist knowledge is often required in interpreting the changes.

Some key issues

- Make sure the feature of the population you are assessing is relevant to your monitoring question.
- Check you have some knowledge or experience of the population features being examined so you will be able to draw some useful conclusions.

Measurement methods

Key information obtained is usually a combination of the following:

- *Sex.*
- *Age:* This can be determined on dead animals from counting the annual layers of cementum on a molar extracted from the lower jaw.
- *Body weight:* Possums can be easily weighed using a spring balance.
- *Presence of pouch young.*
- *Kidney fat levels* (in some scientific studies): On rare occasions this has been used as an index of condition. It involves removing kidneys from the body, dissecting and weighing the fat around the kidneys.

This information can be useful in identifying population trend. For example, identification of many small male possums in a population that has recently been reduced may indicate immigration from adjacent areas where possums are still common.

RODENT ABUNDANCE

The indicator

What is it?

The relative, or absolute abundance of a rodent species, for example, ship rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*) and house mouse (*Mus musculus*).

Discussion

Rodents, particularly rats, have been shown to have great impacts on both vegetation, particularly through damage to flowers and fruit, and native wildlife, as predators and competitors.

Rodent populations undergo large fluctuations both seasonally, peaking in autumn and declining through winter, and between years (Innes 1990). Populations can decline by 90 percent between summer and winter (Warburton 1989). Fluctuation between years appears to be linked to available food source, fluctuations in predator numbers (for example, stoats and cats), and extremes of weather (Innes 1990 and also Brockie 1992). Presence of a high seed production can apparently influence breeding and survival resulting in peaks in populations. This is apparent for mice populations in relation to beech mast years and for rat populations in relation to high seedfalls of hinau and pigeonwood (Innes 1990, Murphy & Dowding 1995).

The presence of these large natural fluctuations can make using this indicator difficult. The usefulness of monitoring rodent populations and whether it will provide meaningful results needs to be carefully considered.

Some key issues

- Understand the large natural fluctuations that occur and how these may affect your monitoring.

FIGURE 45: Ship rat (*Rattus rattus*).

PHOTO: DOC

Tracking tunnels

Involves setting up a small tunnel with an inkpad in the middle and paper at each end so the animal leaves its prints (*see* Figure 46). Each end of the tunnel is baited – usually with peanut butter. Species are identified by their tracks. The tracking frequency is then calculated from the percentage of tunnels tracked by different species.

PHOTO: DOC

FIGURE 46: Tracking tunnel

Comments

- Identification of tracks of different rodents requires care
- Tracking papers can be filed for subsequent re-analysis

References

King & Edgar 1977
Brown et al 1996
'Tracking tunnels for rodents and stoats', p. 79.

Trap catch

Similar method to that for possums, trap rate per 100 trap nights is used as an index of rodent numbers. Traps are set at a regular spacing through a forest area and baited with a mix of peanut butter and rolled oats. Traps are set for three consecutive fine nights, checked and reset each day. Half a trap night is subtracted for sprung but empty traps.

Comments

- Widely used method, considerable comparative data available

References

Cunningham & Moors 1983
Brockie 1992
Fitzgerald 1978
Innes 1990
Warburton 1989

Bait interference

Waxed baits are set and teethmarks recorded. The number of baits chewed is used to calculate a percentage of frequency of bait interference. It may sometimes be possible to identify general differences between mouse and rat teethmarks, but this can be difficult. This method has some limitations in very high rodent densities because all baits may be interfered with, making it is difficult to gain an idea of relative abundance. Individual animals may interfere with more than one bait (particularly if they are not sufficiently spaced), and may return to baits on subsequent nights.

Comments

- Care required to avoid bias
- Not effective at very high numbers
- Experience required to separate species teethmarks

References

'Rodent 'gnaw stick' bait interference', p.83.
Waikato Conservation Board 1997
Warburton 1989
Spurr 1995

STOAT ABUNDANCE

The indicator

What is it?

The relative, or absolute abundance of stoats.

Discussion

Stoats are a significant predator of native wildlife, particularly birds. They are present throughout mainland New Zealand, and can range widely, with home ranges of perhaps 100-200 hectares or more (King 1990). Stoats have been recorded as moving more than 20km in a period of a few weeks.

Abundance varies seasonally with lowest densities in winter and spring, and highest during summer. It also varies greatly with food supply in spring (King 1990). This has been shown in beech forests where higher mouse populations are sustained in the winter following a mast seedfall, which results in much higher stoat reproduction the following spring and high stoat numbers over that summer. Abundance then falls away to more usual densities by the following winter

Stoats are generally present at relatively low densities. Trap catch indices of <1 / 100 trap nights are common, with occasional peaks up to 5 / 100 trap nights. Tracking frequencies may be in the 1-5 % range. This means that large samples and considerable effort may be required to provide useful information on relative abundance, and changes following control operations (Brown & Miller 1998).

The presence of large natural fluctuations, large home ranges, and high mobility mean stoats can quickly re-enter areas where they are not currently present, making the use of this indicator difficult. As with rodents, the usefulness of monitoring stoat populations and whether it will provide meaningful results needs to be carefully considered.

Some key issues

- Low population densities means considerable work is required to monitor abundance.
- It is important to understand the large natural fluctuations that are likely to occur and how these will affect your monitoring.

FIGURE 47: Stoat (*Mustela erminea*).

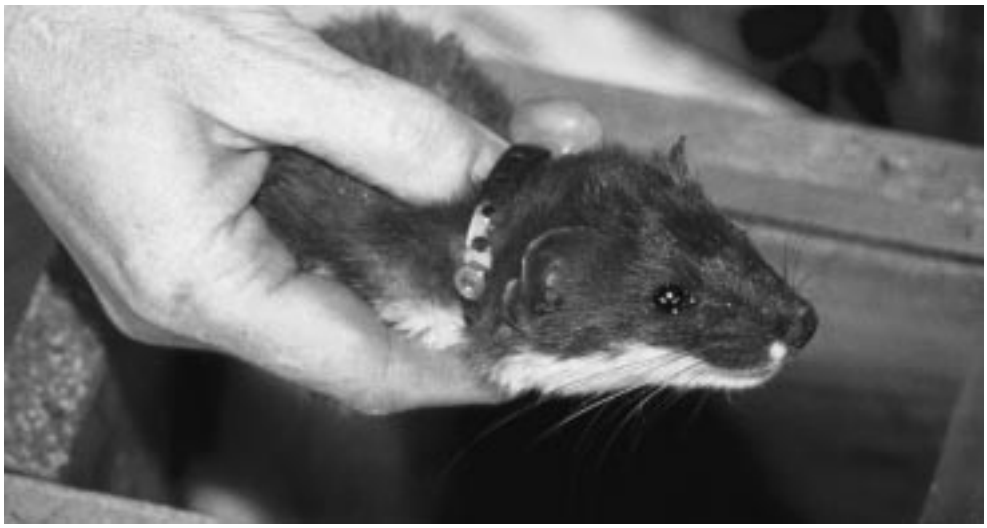


PHOTO: DOC

Tracking tunnels

As described for rodents, baited tracking tunnels are established containing a central inkpad and tracking papers at each end. The number of tunnels containing stoat tracks is used to calculate a percentage of tracking frequency. Methodology for establishing these tracking tunnels is described in 'Tracking tunnels for rodents and stoats', p.79-82, and can also be found in King & Edgar (1977). Brown & Miller (1998), examine sampling requirements.

Comments

- Identification of tracks requires care
- Care required to standardise approach to handling and setting tunnels to allow valid comparison
- Tracking papers can be filed for subsequent re-analysis.

References

'Tracking tunnels for rodents and stoats', p.79
King & Edgar 1977
Brown et al 1996
Brown & Miller 1998

Trap catch

This involves a similar approach to that described for rodents and possums, with traps normally set out at a regular spacing along transects and the catch rate recorded. Because of the relatively low densities of stoats, traps need to be operated for a considerable period, for example, 40-50 traps for 7-14 days. Details on trap catch monitoring of stoats can be found in King & Edgar 1977.

Comments

- Widely used method, some comparative data available

References

King & Edgar 1977
King 1990

CAT ABUNDANCE

The indicator

What is it?

The relative, or absolute abundance of cats.

Discussion

- Cats can be important in forest ecosystems through their impacts on rodents, birds, and invertebrates (Brockie 1992).
- Relatively low population density, and evasive nature of cats, means use of this indicator is usually only suited to scientific research.

Measurement methods

The relatively low density of cats within native forest means that direct measure from, for example, trap catch indices is not generally suitable. Abundance is normally monitored in a generalised way from records of sightings and accidental trapping of cats in possum traps (Brockie 1992). Methods involving the use of 'chalk boards' to obtain foot prints in a similar way to tracking tunnels are currently being examined.

FIGURE 48: Feral cats can be important predators of birds, invertebrates and rodents.

PHOTO: DOC

ALL VERTEBRATE PESTS – GENERAL COMMENTS

General records on the presence of pest animals sighted in a forest area, and observations on their activity can be useful, and important background to other monitoring. Two broad approaches to this are briefly described below.

Observation records

Ongoing records of the numbers of animals seen as people work in or visit the forest can be useful. Also recording the time spent in the forest is important to identify increased sightings caused by a greater number of observers in the forest. Often animals such as goats or cats may have distinctive markings that can be recognised. These can be recorded to allow information to build up about the movement of a particular individual.

Visual assessments

From a combination of the amount of distinctive sign seen such as footprints, faeces, territorial marking, predation and approximate frequency of sightings, a broad assessment of abundance can be gained. An example of such a system that includes some more common animal pests is attached in 'General surveillance checklist for forest ecosystems', p.21.

INVERTEBRATES

The indicator

What is it?

The abundance of particular groups of invertebrates.A variety of other indicators for features such as invertebrate species diversity are possible.

Discussion

Invertebrate monitoring is potentially important and useful because invertebrates far outweigh all other terrestrial species in number with an estimated 20,000 to 30,000 species in New Zealand. Invertebrates carry out a wide range of roles in New Zealand ecosystems such as indigenous forests (Hutcheson et al 1999). Studies also indicate close relationships between insect communities and their habitat (Hutcheson et al 1999). Close relationships between invertebrate populations, birds and introduced predator populations have been suggested (Murphy and Dowding 1995) in some forests.

The key issue with the use of invertebrates as an indicator is their complexity and the large requirement for improved knowledge. In New Zealand it is thought that only about half the 20,000 to 30,000 species have been named and described. Monitoring of beetle species has been suggested as the most attractive invertebrate indicator for New Zealand (Hutcheson et al 1999). In most cases, monitoring of invertebrates is more in the realm of detailed scientific study, though this is likely to change in future as more information becomes available.

Some key issues

- Lack of identification skills.
- Lack of knowledge of New Zealand invertebrate fauna.

PHOTOS: DOC

FIGURE 49: Tree weta (above) and cicada. There are an estimated 20,000-30,000 invertebrate species in New Zealand.

Measurement methods

A variety of methods have been used to trap invertebrates at various levels in the forest, search leaf litter layers, and trap invertebrates travelling up and down tree stems (Brockie 1992, Hutcheson et al 1999).

Sampling for invertebrates should occur during the period when they are most prevalent – between spring and autumn. Samples should be restricted to a shorter period within this, for example, four weeks in December (Hutcheson et al 1999).

Two of the most commonly used sampling methods for assessing invertebrates are:

Pit fall traps

Small containers are dug into the forest floor so invertebrates fall into them for later collection, identification and counting. Containers are shielded from the rain so they do not fill with water, and have some form of preservative solution in the bottom of the container to preserve insects when traps are left for an extended period. A plastic dinner plate supported above the ground on wire pegs can be used to keep rain out of traps, and a saturated sodium chloride (common salt) solution used as the preservative (Hunt et al 1998). Small 'fences' running out from the trap may be used to guide invertebrates and increase the catch.

There is concern from some studies (Hutcheson et al 1999) that this method does not always give reliable and useful results, and samples a relatively small part of the insect fauna. However, it is generally easier to establish this type of study than to use malaise traps.

Comments	References
● Likely to be easier to use than malaise traps, but only samples ground dwelling invertebrates	Brockie 1992 Hunt et al 1998
● Lack of identification knowledge is a problem	Hutcheson et al 1999

Malaise traps

These are designed to capture low level flying and hatching invertebrates, which are herded into a container for identification and counting. A small tent-like structure is erected to trap invertebrates emerging from the ground as well as those flying within about a metre of the ground. Studies suggest the majority of invertebrate biodiversity is in this zone (Hutcheson et al 1999).

Comments	References
● May be more effort than pit fall traps, but samples a greater range of invertebrates	Hutcheson et al 1999
● Lack of identification knowledge is a problem	

CLIMATE

The indicator

What is it?

Records of important climate measures that may affect forest ecosystems such as monthly maximum and minimum temperatures, monthly rainfall, salt laden storms, and major windstorm events.

Discussion

Climate can have important impacts on forest condition, through damage caused by salt laden storms 'burning' foliage, drought stress, or damage from windstorms. There also appear to be relationships between climate and fruiting and flowering intensity for some species. For example, hinau fruiting intensity appears to be linked to temperature in the previous summer (Cowan & Waddington 1990).

Obtaining basic climate information relevant to the forest area being monitored can be important in interpreting monitoring results.

Some key issues

- Identify existing sources of climate data relevant to your site. There is often good data being recorded, you may just need to get occasional access to this information.

Measurement methods

Organisations such as National Institute of Water and Atmospheric Research (NIWA) should be consulted for availability of data. Useful information includes monthly information on:

- Maximum and minimum temperatures
- Total wind run
- Wind directions
- Rainfall

Make simple observations of climatic events in your area, for example, a period of strong salt laden winds which occurred between certain dates, or that the area is very dry, and certain tree species are wilting.

When dealing with small forest remnants, changes in microclimate can be important. The most common change that can occur is an increase or decrease in exposure to wind because of a change in shelter. A common example is where plantation forest is harvested from around a small native remnant, which is then more exposed to the extremes of climate.

PHOTO: DOC

FIGURE 50: Climate has major impact on forest ecosystems.

HYDROLOGICAL/DRAINAGE CONDITIONS

The indicator

What is it?

Drainage conditions including aspects such as height of the water table, and presence of any surface water.

Discussion

Drainage conditions are important in determining which type of forest vegetation occurs on a particular site. Subsequent changes in drainage conditions have an important impact on vegetation condition. For example, a small remnant of kahikatea swamp forest may decline in condition if adjacent agricultural drainage lowers the water table. Alternatively, a change in drainage patterns that results in more surface water being present in an area of forest reserve may kill species requiring good drainage.

Some key issues

- Drainage is only likely to be an issue in flatter terrace or plain areas.

Measurement methods

If detailed information on water table level is required, holes can be dug in the area to form small wells. The water level within these wells can then be monitored. It is important to obtain information on the period for which the water table is at a certain level. The water table may fluctuate in height, but it is longer term changes that are likely to be most significant.

Records of observations can be kept on the presence of surface water or flooding in the area, and how long this surface water stays. This can provide an indication of the frequency of flooding.

Observations on changes in drainage patterns are useful, such as a changing stream course affecting the area, or development of a drainage system in association with agricultural or urban development.

FIGURE 51: Changes in drainage patterns, due to natural causes or human development, can have important impacts on vegetation.

PHOTO: DOC