



Survey of occurrence and abundance of biotic pests

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Prevention of damage

- The prevention is the cheapest control method!
- Necessary condition to prevent damage is identification of injurious factor.
- In case of insect, partially also fungi we should know fluctuation patterns of individual species.
- To predict the population changes, we use „forecast“ in forest protection. It consists of survey and prognosis.
- Survey evaluates the abundance, prognosis tries to make an prediction for shorter or longer period.

Types of survey

- Individual survey – it is focused to individual species of forest pest. We evaluate number of pest individuals per some unit.
This is possible to do in cases, when we observe outbreak of ONE species and other species are not overpopulated.
- Survey of community– it is focused to community of pests in the forest stand.
E.g. We can find rich community of caterpillars on tree species – and we evaluate complex impact to foliage.

How to make survey?

- Both types of survey it is possible to make „briefly“, when survey is done into optimal biotops of the pests – on large areas. The precise survey is done on scheme of survey or monitoring points. The last mentioned method is usually tim-consuming and to make appropriate survey it is necessary to use statistical methods.
- Prior the survey it is necessary correct identification of pests, because different species have different life histories. After identification, we can make the survey by two methods: DIRECT survey, when directly observe some of developmental stages, and NON-DIRECT, when pest abundance reflects results of some life-to-connected processed (excrements, defoliation, presence of number of galleries etc.).

Axiomata for survey

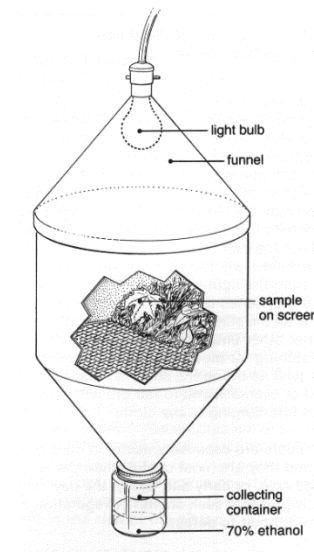
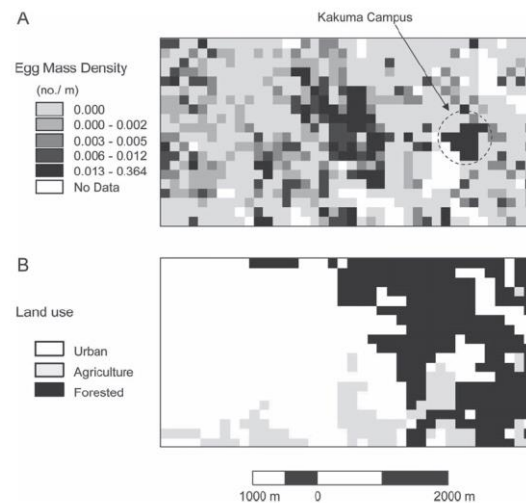
- The survey is usually done by chance selection via defined manual (defined number of trees or area).
- There is several axiomata which it is necessary to apply:
- Correct identification of pest, and/or its symptoms;
- Optimal developmental phase of the pest;
- Etologically optimal time for survey;
- Optimal selection of sampling point with regard to ecological requests of pest to environments; and
- Economically and logically correct scheme of abundance survey.

Spatial and temporal dimension of survey

- Evaluated abundance of the pest is always connected to space and time.
- The present day survey may indicate current and/or future damage of the stand.
- It is really important, if the abundance was increased on tree, trees group, stand, local scale or country scale...
- Found value is compared to threshold values, which are usually know from the past and which indicates, when some of the pests overcrossed the threshold of economical harmfulness.
- In some cases, it is necessary to make changes in presently valid numbers – because of climate changes.

Survey of abundance of eggs/egg masses

- Sample method is based on counting the egg masses on sample. As a „sample“ may serve branch, sprout, foliage. To realise variability of the occurrence of the pest in the environment, the samples are taken from different places and from different parts of the attacked tree.
- Combined sample-light box method is used when egg masses are laid on cryptic places. Taken samples are put to light box and in laboratory conditions it is counted the number of hatched larvae. The number of larvae is connected to sample branch.
- Method of fixed survey plots is used in case when the pest outbreaks repeats regularly and/or is economically significant. This method is suitable for the species, which egg masses do not have preferred places. In this case the optimal sites are surveyed and the result is recalculated to branch, tree, etc.
- Walking method is used mainly in case of „briefly“ done survey. The reason is, that we need to evaluate the abundance by quick method on large areas. Usually it is limited by time, or the distance.



Survey of larvae abundance

- In case of sample and combined sample-light box methods we can use the same methods as in case of egg masses. Sample method it is possible used only in case of species firmly connected to the sample.
- Direct counting the larvae is used in forest nurseries or young stands:
- Direct counting the larvae in the canopy,
- Beating of larvae on textile or using the textile beating tray,
- Cutting down the infested tree, when its canopy fall down to prepared textile plates. Then, the individuals of the pest are counted. The numbers are recalculated to some unit.
- Pellet (excrements) method is very useful for the species living in the canopy. We count the number of produced pellets per some time. Pellets tray has stated dimensions and numbers on which the pellets are counted. The number of pellets and threshold numbers are species specific.



Survey of larvae abundance

- Gluing is used on all species of insect pests, which larvae, or adults migrate on tree trunks from the ground to the canopy. In the stands, where it is possible to predict increased abundance is prepared several sample trees per ha, on which the sticky belt is prepared by using the glue. The belt is prepared usually in the height of 1.5 m in the width 3-5 cm. It is necessary to clean the trunk prior the application. The number of captured larvae/adults is recalculated per 1 cm of the trunk length.
- Soil probes are used for the species which live, or stay in the soil, where we can count them by direct counting. Soil probes are prepared in connection to pest species in number several to several ten per a ha. Their size is usually 0,5x0,5 m and depth depends on species, which we want to survey (15-25 cm).



Survey of abundance of pupae and cocoons

- To make survey of this developmental stage is used sample method and the method of soil probes.
- Sample method it is possible to use only for the species which are firmly tied to the sample substrate.

Survey of adults abundance

- This method often uses the pheromone monitoring, which is based on commercial production of synthetic pheromones of some insect pests.
- Synthetic pheromon is installed to special traps, which serve as an reservoir of captured adults. On the base of number of captured individuals it is possible to estimate abundance of the pest. Number and spatial scheme depends on behaviour of pests.
- We use two types of pheromones: agregation – which are used for trapping the bark beetles, a sexual – which are used maily for trapping the moths.



Survey of adults abundance

- Many insect species are attracted by some portion of light spectrum. This fact is used for brief evaluation of their presence and/or abundance. Number of captured adults per time unit indicates abundance values.
- For survey it is also possible to use ground light boxes. Those are used for of species which pupate in the soil or litter. Ground light box is box from dark material, which has transparent palce wich collecting box in the top. The emerged adults it is possible easily evaluate.
- In case when adults live in the soil we can use individual soil sampling followed by manual separation and/or using the light boxes or xereclrectors.



Survey of adults abundance

- Trap trees are quite simple method using natural attractants of weaken/ almost dead trees. The beetles bore into trunks and we can count the entry holes.
- Infestation of trap tree is significantly dependent on life history of surveyed species – thus we need information about potential pests.
- Trap trees it is possible to prepare as laying or standing ones.
- Number of entry holes we can compare to threshold values. If there are more trap trees prepared, we can make also spatial distribution of infestation.
- Laying trap trees are simpler, some species do not attack them however. We should prepare standing trap trees in this case – interrupting the floem and young xylem. We can do it by chain saw – optimally in wedge-like shape. The cut cannot be too deep – for safety reasons. 3-8 weeks later we can take a look and estimate the number of entry holes.



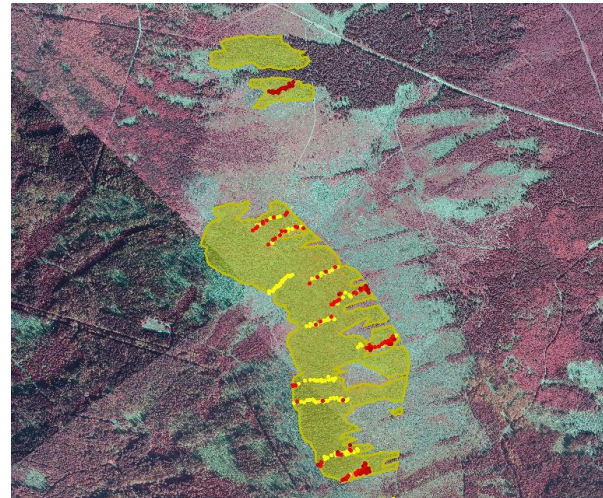
Survey of adults abundance

- For some species we do not prepare whole trees, because adults prefer specific parts of trunk.
- In this case we can use trap bark, trap logs and/or trap branches.
- Eg. Some of curculionids developing on roots are attracted by bark or bottom part of coniferous.



Other methods

- There is many additional methods which we can use for specific situations. They are used mainly in case, when doing nothing can make serious damage and economical loses.
- One method, which need special equipment is using of the X-rays. We can easily check the damage of seeds etc.
- We can also establish permanent study plots – and use camcoders to stude life-histories of various insect pests or fungi pathogens.
- Specific methods are based on aerial survey – via using planes, satelites, or now drons. Some data from those surveys it is necessary to verificate via ground survey. Then, we usually use GIS for processing of spatially distributed data.





Data collecting and making the forecast

- With increasing area of plantations you will have to solve two main problems:
- How to cope with invasive species,
- How to efficiently protect newly established plantations.



Forecast of potential danger

- It would be fine, if there is some authority dealing with such problems. Do you have some info about such institutions in the ministry in Vientiane?
- It is strongly recommended to prepare strategy in ecosystems protection which then will be taught at universities.

Regulation of abundance of biotic pests

- It is preferred to apply in forest protection integrate pest management (IPM), which is efficient, as much as possible environmentally friendly and economically acceptable. The goal of IPM is not complete eradication of pests. Opposite is needed for an invasive species.
- The main goal of IPM is to keep population of pests under threshold of economical damage. This means, the pest may be present in the forest, but does not caused damage, which cause economical loses.

Regulation of abundance of biotic pests

- Principles IPM declare the use of two main tools: a) systematic prevention and b) using ecologically accepted control. The main effort is laid on minimization of optimal conditions for the pests.
- If we are not successful with prevention, the direct control measures are applied. IPM appoints to preference of ecological acceptability of control. Thus, the combination of biological, biotechnical and other ecologically friendly methods are supported
- In necessary cases, the chemical treatment is done.
- Do you have special list of chemicals which it is possible to use in Laos????

Regulation of abundance of biotic pests – main rules

1) Pest always must be considered in connection to existing conditions in the forest ekosystém according to following criteria :

- Which direct losses causes pest in the forest?
- Does it cause increasing mortality?
- Does it decrease the trees increament?
- Does the damage cause change of soil parameters?
- Does the damage have positive impact to weeds?
- Does the damage decrease biodiversity?
- How the treatment influences the forest ecosystem?
- What about costs for treatment a possible economical lost due to decreased increament?

Regulation of abundance of biotic pests – main rules

2) The priority is always to keep pests under the threshold where economical losses starts. To fulfill this goal it is necessary:

- To form stabile forest communities.
- Via suitable methods increase the resistance of forest stands.
- To manage forests by the ways close-to nature. There is exception in case of intensively managed plantations. The nature close forests and plantations should be in balance.

Regulation of abundance of biotic pests – main rules

3) If control measure is really needed, the next manual is recommended:

- It is necessary to make decision, if the pest is really,
- Then we get additional info about pest life-history and its present function in the ekosystém,
- Prepare an optimal strategy for control on the base newest knowledge,
- Make optimal strategy, evaluate the effect and upgrade additional measures.

Regulation of abundance of biotic pests – main rules

4) The treatment cannot have destructive impact to the ekosystém and following rules it is necessary to keep:

- We select optimal treatment, which would keep the pest under economically important harmless with minimal impact to environment,
- The treatment is done by using the lowest possible doses and by optimal application,
- We precisely define the area of forest stands where treatment is necessary,
- We define optimal date for the treatment in sense of life history of pest, its enemies and food tree.

IPM and AWM (area widemanagement)

- IPM is modern concept. It needs much more precise info about the life history of pests and also about environment. The environment is complicated web of life – and if we cut some links, the whole system may be changed.
- Individual methods of IPM are under permanent change, what is important from the point of view of education of students.
- We all also MUST realize, that the pests must not be treated only locally, but the concept of Area-Wide Management is needed to be applied.