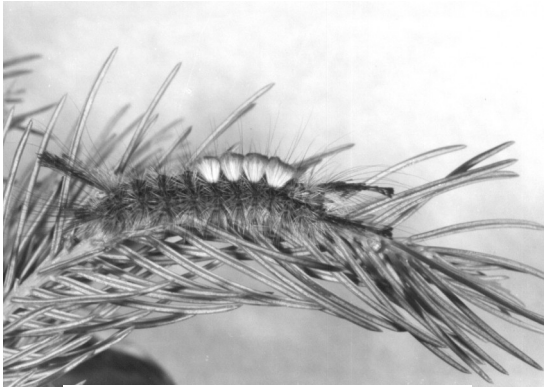
DOUGLAS-FIR TUSSOCK MOTH

State Forester Forum

The Douglas-fir tussock moth is a native insect found throughout the range of its Douglas-fir



Douglas-fir tussock moth larva

and true fir hosts in the western states and British Columbia. It is one of many conifer-feeding insects that contribute to ecological processes of western forests. Feeding by the caterpillar stage causes defoliation of the host trees.

The insect is known for its periodic outbreaks on a 7 – 10 year cycle. During outbreaks, severe timber losses have occurred due to tree mortality, reduced radial growth and top kill.

Trees defoliated and killed by feeding of tussock moth caterpillar

The value of these impacts is largely determined by land owner objectives and management philosophy. During a 2001-2002 outbreak two major timber companies in North Idaho removed approximately 14 million board feet of timber that was killed or heavily damaged by tussock moth. Thousands of non-merchantable trees were also killed. This devastation caused a major disruption to management plans.

Pheromone-baited sticky traps have been used to monitor populations and watch for the development of outbreaks. By observing trends we can be prepared to take whatever action is deemed necessary when an outbreak does occur.

Sticky Traps

Traditionally, outbreaks have been treated with chemical pesticides, sprayed from aircraft to protect trees from heavy defoliation.

Currently, there are several strategies for dealing with this insect including long-term control aimed at preventing damage through forest management and short term control dealing with outbreak populations when they do occur.

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Insect and Disease

No. 19

July 2008

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Chemical pesticides, sprayed from air-

Long Term control achieved through stand management

Favoring non-hosts: Since the principle hosts of the tussock moth are Douglas-fir and true firs, and non-host species such as pines or western larch are usually not fed on, management activities that favor non-host conifers will, in time, produce stands that are resistant to this insect. Selective harvests or thinning that leave pines as a seed source or inter-planting with non-host species will ultimately convert the stands to a less susceptible condition. Management activities of this nature not only help prevent problems from tussock moth, but also contribute to reduction of danger from wild fires by reducing ladder fuels and the total fuel load. They will also help reduce losses from root diseases that in some areas tend to attack the shade tolerant species.

Thinning host stands: Thinned hosts, while not being resistant to defoliation and subsequent growth loss, have been observed to recover more rapidly and to a greater extent than unthinned stands after being defoliated by Douglas-fir tussock moth. However, caution needs to be expressed for thinning in stands of Douglas-fir and grand fir where the leave trees are these same species. In the Interior West of the Northern Rocky Mountains, these two species are very susceptible to various root diseases, and thinning has been observed to increase the activity of these pathogens resulting in greater infection and tree killing.

While long-term management activities are generally considered desirable, they may not meet the management objectives of every land owner. Non-industrial owners specifically, may not be interested in stand conversion to non-hosts, or they may prefer having grand fir and Douglas-fir as the principal components of their forests. Industrial owners may not be able to adequately cover all susceptible ownerships in a timely fashion. Markets may not allow the selective removal of just the host species. Also, as much as we hope to be able to use pheromone trapping and other monitoring methods for early detection of impending outbreaks, we are not always successful in our efforts. Thus, there is continuing need for techniques and tools for treating outbreak tussock moth populations to avoid damage.

Short term control achieved by treatment of insect populations

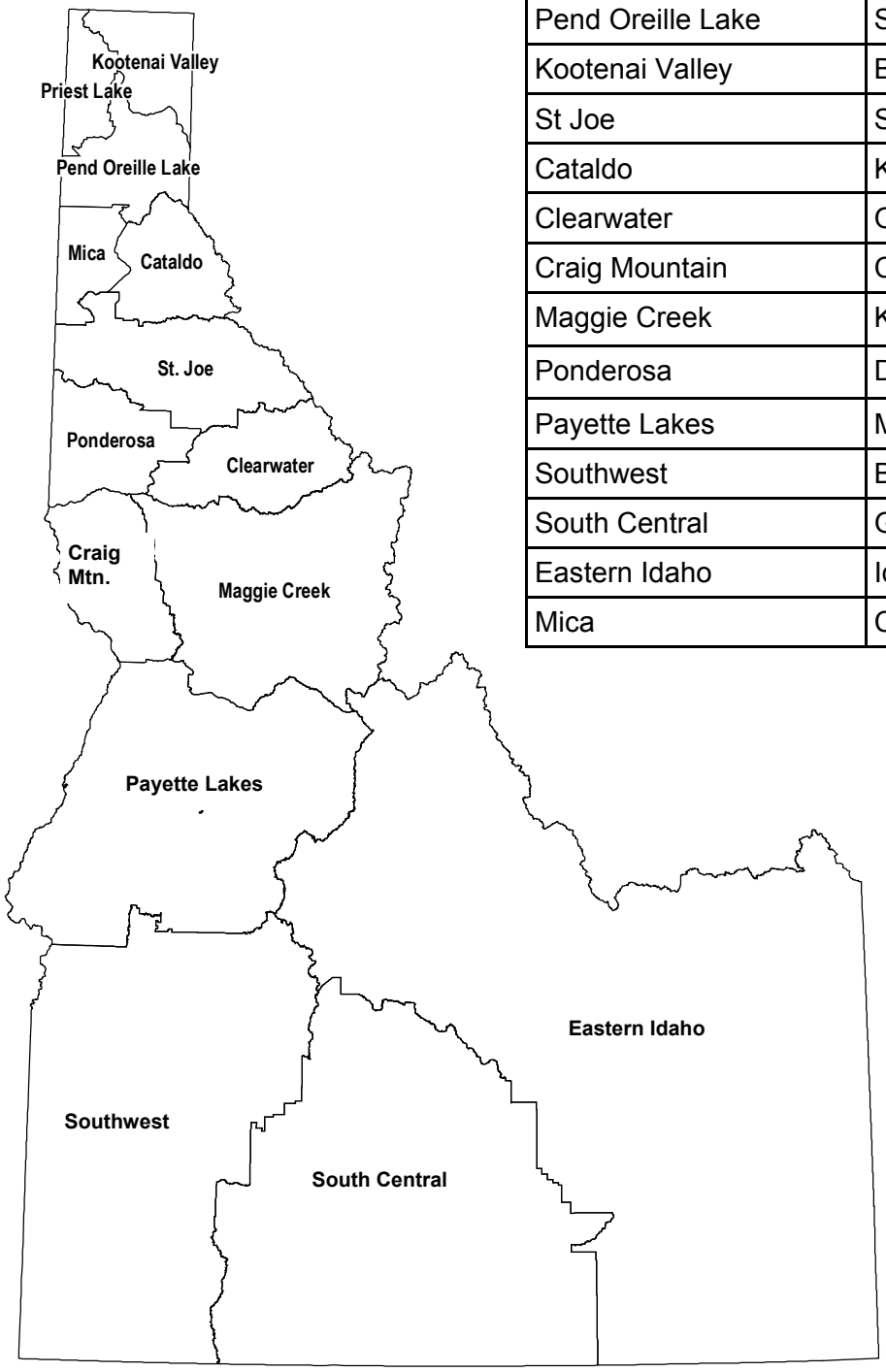
There are several options available for management or control of the insect itself, most aimed at killing larval stages. These include the traditional application of broad spectrum chemical insecticides and the increasing use of biorational pesticides such as insect growth regulators, naturally occurring bacteria, virus, and pheromones.

Chemical Insecticides: Current availability of chemical pesticides needs to be verified with University Extension or other agencies or companies. Some may be appropriate for forest use; others are registered for ornamental use. The primary shortcomings of chemical pesticides relate to their lack of specificity and in some cases their persistence. Advantages include their relative low costs, ease of application, and quick action which provides good foliage protection.

Biorational Pesticides: The “biorational” name is derived from two words, biological and rational, indicating pesticides of natural origin that have limited or no adverse effects on the environment or beneficial organisms. Biorational insecticides are divided into two categories, **biochemical** (insect pheromones and insect growth regulators (IGRs)) and **microbial** (bacteria and viruses). With their “softness” on the environment, this class of pesticides will undoubtedly gain greater

importance in future treatment programs.

- Insect Growth Regulators (IGR): Once ingested, these compounds disrupt the ability of the caterpillar to complete development, resulting in the death. This mode of action provides for a narrower spectrum of activity, affecting fewer insects other than the target. Some compounds are very selective affecting only the caterpillars of moths and butterflies that are present at the time of spray. Non-target toxicity and environmental persistence have not been major issues. These characteristics make IGR compounds very suitable for treatment of tussock moth infested forests.
- Microbial Pesticides: Two microbial pesticides are available for treating tussock moth; (1) formulations having Bacillus thuringiensis (Bt), a naturally occurring bacterium as the active ingredient, and (2) formulations using a nuclear polyhedrosis virus (NPV) as the killing agent. Bt formulations are commercially available from several producers, and have been used extensively on numerous forest defoliators. NPV is perhaps the most important natural cause of decline of outbreak populations of tussock moths and has been developed by the USDA Forest Service as a sprayable control tool. It is available only as part of cooperative effort with the Forest Service or a State agency. The advantage of these products is their narrow range of targets. B. *thuringiensis* var. *kurstaki* only affects the larvae of moths and butterflies. NPV only affects tussock moths, making it an ideal pesticide from that aspect. Their shortcomings are that as living organisms, they are short lived and very sensitive to adverse environmental conditions that can easily render them ineffective. Also, the virus is slow to develop requiring considerable time to affect the feeding caterpillars providing time to allow damaging defoliation. Thus, when there is need to protect the current year's foliage, the virus would not be a good choice.
- Mating disruption using insect pheromones: The female tussock moth is flightless. She uses a sex attractant pheromone to attract the male for mating. This material has been synthetically reproduced and is the basis for the pheromone trapping program that has been used for approximately 20 years. It also serves as the basis for a mating disruption strategy where populations are reduced by suppression of mating. Large amounts of pheromone are introduced into the forests by the aerial application of very small, pheromone-charged plastic dispensers creating thousands of point sources of pheromone. The males are unable to orient to the single plume of pheromone being emitted by a female and mating is disrupted. If populations are very high, chance mating may occur, so this technique works best at low populations. The success of this method thus depends on being able to identify the early stages of an outbreak. Treatments are most effective, and populations are held at low levels preventing tree defoliation and damage. The advantage is that only tussock moths are directly affected. The disadvantages come by way of challenges in the application process and in high costs associated with the production of the material. Management objectives will be the first factor in deciding whether to control tussock moth outbreaks. Other considerations include stand maturity (old-growth stands may not be damaged enough to warrant treatment, especially if harvest is anticipated within a year or two or salvage is an option); stand composition (stands with 50 percent or more non-hosts may not need treatment); or slope position (stands in creek bottoms usually suffer only minor damage). Programs integrating both long-term practices to increase stand resistance and short-term treatment of populations, when necessary, will produce the best results.

FOR MORE INFORMATION CONTACT ANY IDAHO DEPARTMENT OF LANDS PRIVATE FORESTRY SPECIALIST

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