MINISTRY OF ENVIRONMENT AND TOURISM

REDD+ MONGOLIA
Building resilience, livelihoods and economy

DEALING WITH INSECT INFESTATIONS IN MONGOLIA'S BOREAL FOREST

Fast facts on Pests in Mongolia	
14.2 million ha	Boreal forest area
<1 percent	Area of the boreal forests affected by insect infestations[1]
>40 percent	Annual forest budget spent on pest control measures[2]
Natural occurrence	Pests are a natural part of ecosystems; natural processes control their populations.
Building ecosystem health and resilience	Sustainable forests management is the most effective way to build resilience and management insect infestations
Major forest pests	Major pests include the Siberian silk moth (*Dendrolimus sibiricus*), Jacobsen's spanworm (*Erannis jacobsoni*), Asian gypsy moth (*Lymantria dispar*), and rusty tussock moth (*Orgyia antiqua*). Secondary bark and wood-boring insects such as *Ips*, *Scolytus*, *Buprestid* and *Cerambycid* beetles can kill trees weakened by defoliation and/or fires.

Native insects and diseases play an essential ecological role in all natural forests. They occur naturally and help renew forests by removing old and/or weak trees, recycling nutrients and providing new habitats for flora and fauna alike. Most insects provide their ecological benefits almost invisibly and are hardly ever talked about. They make the national news only when they become obvious and when their work turns into infestations that are so severe that they destroy or damage large areas of commercially valuable forests – causing negative economic impacts – or social-culturally important areas with significant recreational values (Figure 1).

Forests are more vulnerable to pest outbreaks when they are stressed by droughts, fire or competition for resources such as water, minerals or light, especially very dense forests that have not been thinned. There is a general believe that weak trees are more likely to be targeted by pests than healthy ones, which is predominantly the case for secondary bark- and wood-boring beetles. However, Mongolia's boreal forests are mostly affected by defoliating insects (Figure 2) that damage trees by feeding on leaves or needles, removing the photosynthetic tissue critical for plant maintenance and growth. A significant loss of foliage results in reduced growth, increased susceptibility to attack by other insects and pathogens, and sometimes mortality.

Figure 2: Larva of Siberian silk moth

[1] FRDC, 2017: Forest Resource of Mongolia. Forest Research and Development Center. Ulaanbaatar. Ministry of Environment and Tourism, Mongolia.

[2] UN-REDD Programme, 2018. Assessment of Financing Mechanisms and Options for Mongolia's REDD + Action Plan. Ulaanbaatar, Ministry of Environment and Tourism, Mongolia (Link).

Figure 1: Bogd Khan Mountain (forest stand attacked by Siberian moth)

The Forest Research and Development Center (FRDC, 2017) estimated that insect infestations have affected an estimated 135,000 hectares or about 1 percent of the total boreal forest area in Mongolia, which compares with 13 percent that have been damaged or destroyed by fire.

How this compares to other boreal forest countries, is difficult to answer. About 75 percent of Canada's forests and woodlands are located in the boreal zone, which translates into 307 million hectares in total.[3] Between 2005 and 2015, the aerial extent of infestations fluctuated significantly, reaching around 12 million hectares in 2015 for three species only (Figure 3). Over the ten-year period about 60 million hectares contained defoliated trees, which is around 20 percent of the total forest area. While the Mongolian and Canadian figures cannot be readily compared, they indicate to some extent that in Mongolia insect infestations are a comparably minor issue.

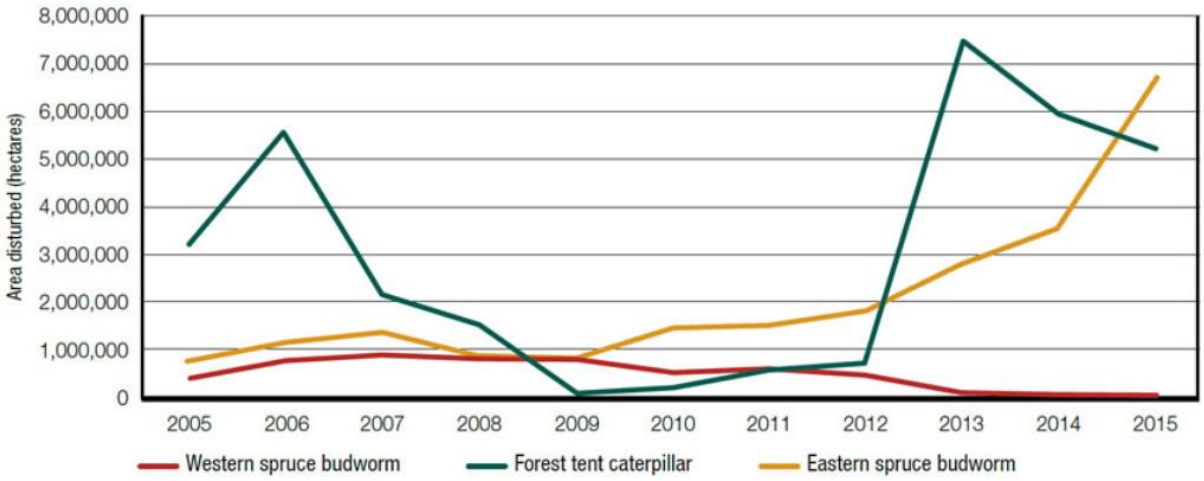

Figure 3: Forest area containing defoliated trees for three insects in Canada (2005-2015)[4]

[3] https://www.nrcan.gc.ca/forests/boreal/17394

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The FRDC is conducting forest pest distribution surveys annually on over 2 million hectares of boreal forests. The network of surveyors communicates the locations of insect activities (Figure 4). However, currently monitoring is not conducted in an efficient way which poses a number of problems described below.

Figure 4: Eggs of the Siberian silk moth on larch foliage

In Mongolia, pests are seen as an enemy that must be eradicated at all costs. Pest control operations are conducted on about 110,000 (average from 2006 to 2014) to 150,000 hectares annually. The proportion of current annual budget of the Ministry of Environment and Tourism (MET) for pest control measures is significantly higher than in other similar countries. They account for between 40 and 75 percent of the forest budget (Figure 5). There is no effective monitoring and evaluation of pest control activities and whether it has a significant impact on reducing pest populations and damage to forests.

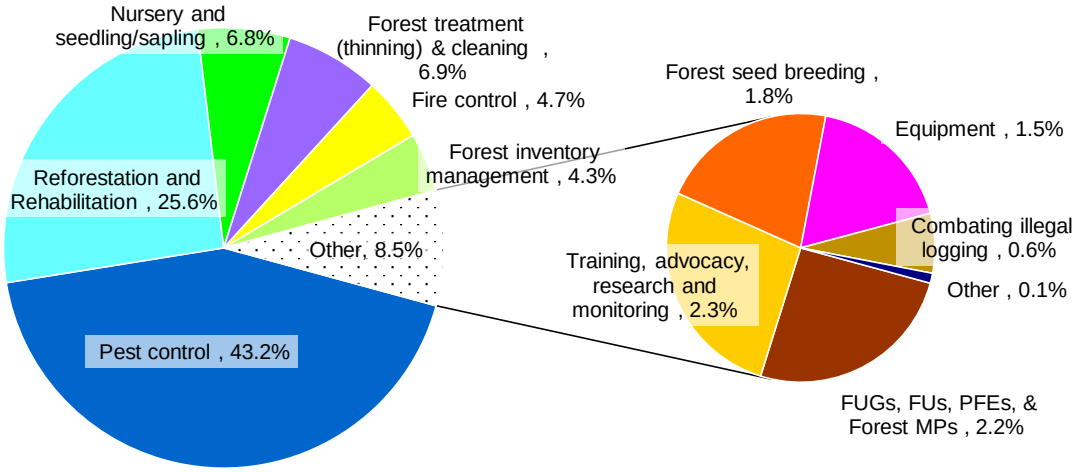

Figure 5: Share of average annual budget expenditure of MET for forestry and forest conservation in 2013-2017

Shifting towards more effective control and modern forest health protection

The goal of modern forest health protection is to manage the trees and forests to become more resistant or resilient to damage from pests and other environmental factors. The amount of damage caused by insects depends on a combination of the vigor of the host trees, the size and virulence of the specific pest population, and the physical (weather, nutrients, topography) and biological (predators, parasites present) environment. Equipped with this knowledge, a sensible three-pronged approach is: strengthen the trees, moderate the environment, and weaken the pest insects. Most forest managers also have to make choices about where they choose to use scarce resources. Forest management influence the tolerance for pest activity, and whether prevention or response should even be used.

Insect outbreaks tend to increase and decline in four phases (“Release”, “Peak”, “Decline” and “Postdecline”). It is important to identify and understand the *unique* pattern and contributing factors

that affect each insect pest and forest type. This includes the specific factors that trigger the release and rapid growth of populations, the outbreak threshold (insect numbers that indicate an outbreak has started), the typical duration of an outbreak, and the factors that contribute to the outbreak decline. This information informs pest control decisions. It is particularly important that control activities:

1. are applied early in an outbreak, as soon as the "Outbreak Threshold" is reached, to avert the "Release" from continuing;
2. are avoided after the "Decline" has initiated because the outbreak will subside without human effort and expense; and
3. do not interfere with the natural factors such as beneficial predators and parasites that are causing the "Decline".

FRDC surveyors are tasked with identifying insect outbreaks as quickly as possible; often relying on visible defoliation. Unfortunately, this may be later than a theoretical "Outbreak Threshold" and the population may already be very large. More effective control would benefit from:

1. Additional insect outbreak "early warning" information that focuses on the most likely significant insect hotspots and forest management objectives (e.g. timber, recreation, human health) that are most vulnerable to unacceptable damage.
2. Refinement of established pest control standards to more effectively apply control early in an outbreak cycle to effectively prevent full "Release" of insect populations.
3. Increase of quality control evaluations such as monitoring spray deposition and untreated reference plots to ensure that applications are effective in terms of timing, coverage, droplet size and being biologically active.
4. Continuation of focusing specific control techniques (see e.g. Figure 6) on the life stages of the insects that are vulnerable.
5. A review of the cost-effectiveness of the control activities to assess whether budgets would be better directed to other forest management activities.
6. Avoidance of general insecticide treatments when the outbreaks are already in "Decline".

Figure 6: Use of a backpack sprayer for small areas

Thinning very dense stands (Figure 7) and sustainable forest harvesting also contribute in regulating pests. In fact, sustainable forest management would also help to reduce frequencies and intensities of fires and could generate employment, i.e. an opportunity to kill two birds with one stone.

Mongolia's commitment to use only non-chemical pest controls is important and must be continued. This should be strengthened and enforced particularly at the local level.

Finally, awareness of the public and decision-makers alike on the role of insects and diseases in natural ecosystems needs to be raised. Nobody is asked to embrace insects as friends. But they do not deserve to be viewed as the forest's enemy only.

Figure 7: Dead larch (Larix sibirica) in a dense forest stand after Siberian moth massive outbreak in 2000

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