

## **Section 5: Environmental Stress and Susceptibility of Lodgepole Pine to Mountain Pine Beetle**

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### **5.1 Introduction**

Since 2006, Alberta Environment and Sustainable Resources Development (AESRD) have conducted detailed annual assessments of the state of the invading MPB population in central and northern Alberta. In particular, they have measured “r-values”, the ratio of surviving offspring to parent attacks, for many infested stands throughout the region. An r-value is determined for an infestation within a stand by sampling attacked trees during late spring just before beetles emerge and disperse, thereby capturing all of the generation mortality arising from the biotic and abiotic conditions associated with the stand. Together with stand-level parameters (e.g. species, density, age, etc.) recorded during the sampling, variables derived from a detailed stand-level vegetation resource inventory dataset, and weather data, r-values can be used to predict the size of an emerging MPB population. We would anticipate a link between these R values and the climate stress layers shown in the climate / species section of this report.

### **5.2 Methods and Materials**

As an integrated component of the Alberta Innovates project we also compared the climatic stresses on lodgepole pine in Alberta (as described in the species climate section), the major host species of the beetle, with the r values described above.

To do so we extracted for each plot with an R value, the stress of the lodgepole pine species layer from 2005 – 2009 and compared them.

### 5.3 Results

Figure 4.1 shows the distribution of the R plot locations through Alberta, Figure 4.2 shows the predicted long term range of Lodgepole pine within Alberta (as estimated using methods discussed previously in this report) and Figure 4.3 shows the stress of the lodgepole pine within the same time period.

Figure 4.4 shows the relationship between Lodgepole pine predicted stress from 2005 – 2009 and the observed R values. As the figure illustrates, as stress for the tree species increases (X axis decrease) the R values increase, indicating trees which are more stressed in their long term range have higher levels of beetle activity. A threshold response is clearly evident, with stands that are not undergoing any stress or only 1 year of stress over the time period (X value = 5 or 6) the R value rapidly decreases. At sites where the tree species is stressed greater than 2 years of the 6, then beetle occurrence is much greater and remains at that rate regardless of additional stressful years.

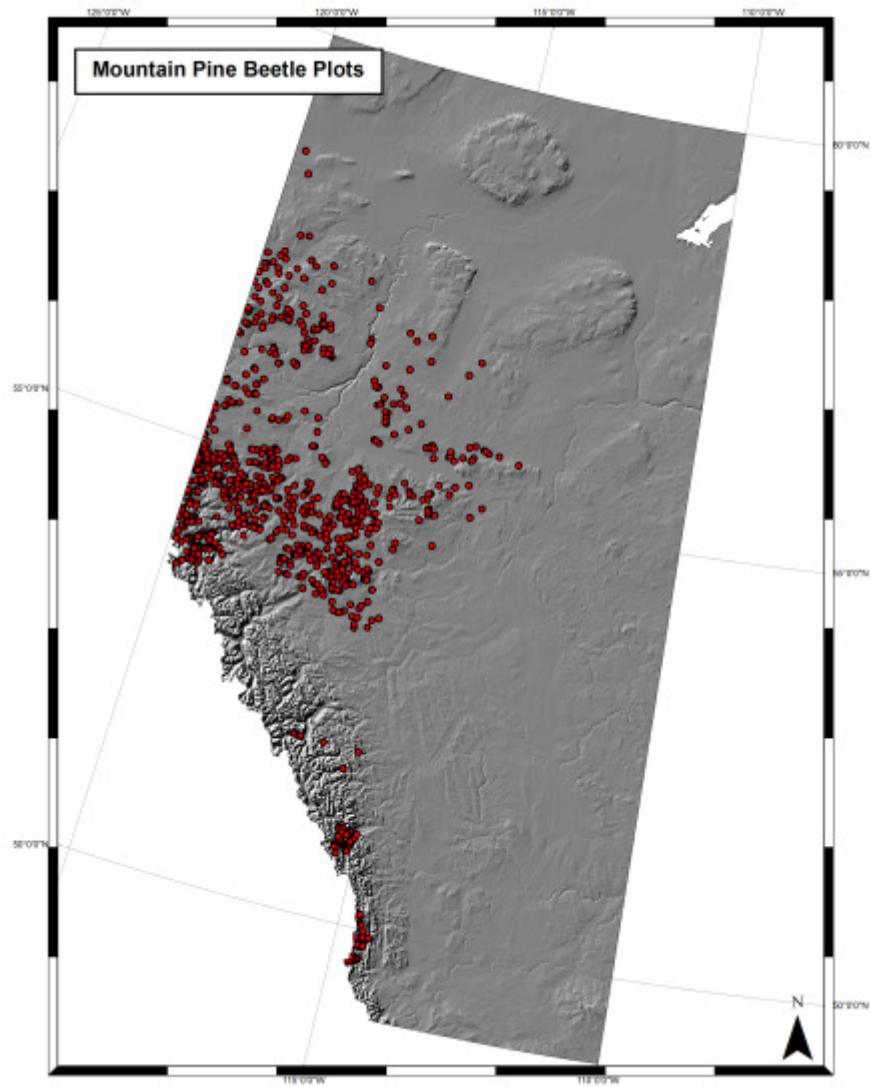


Figure 5.1: Location of plots with R values available across Alberta.

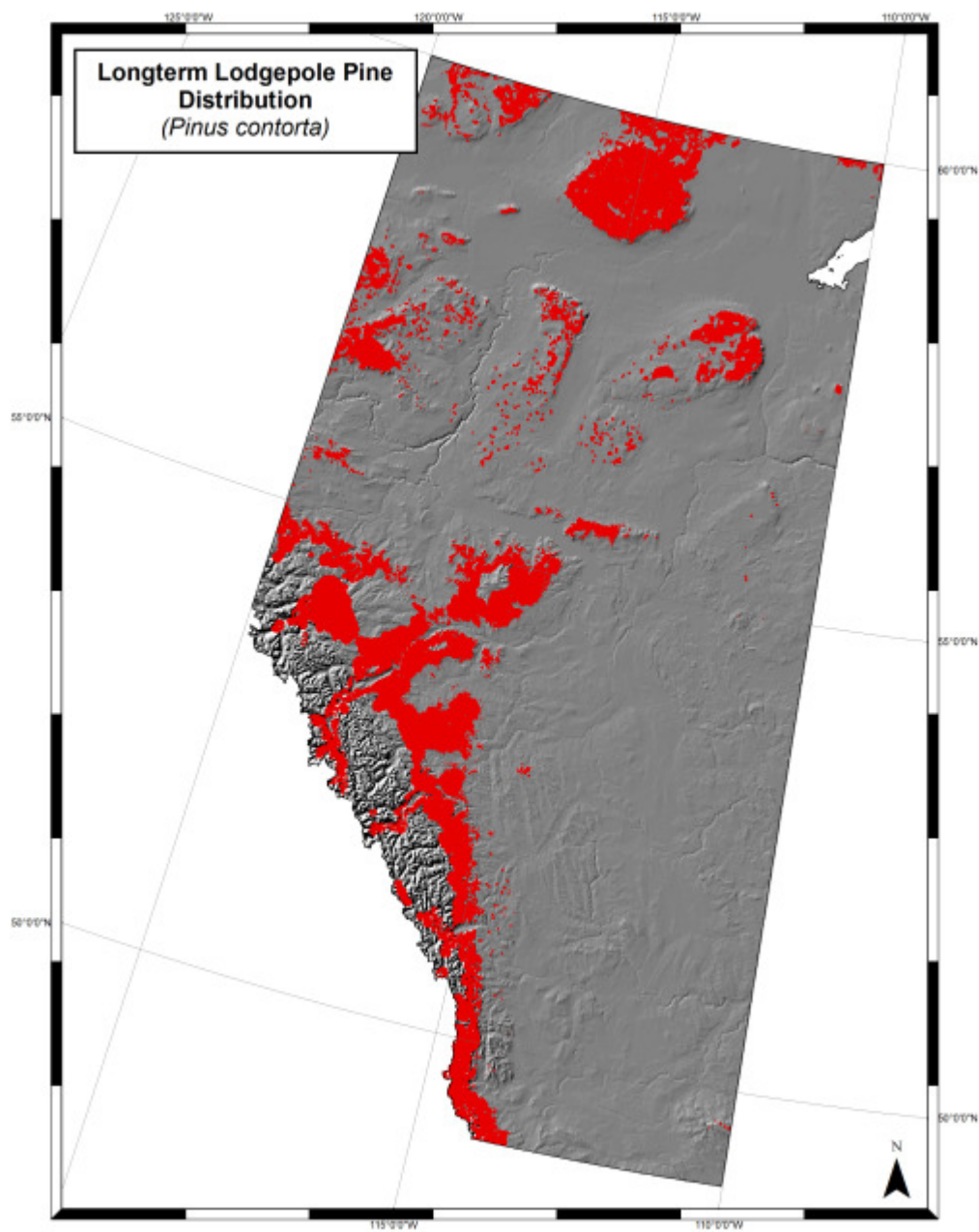


Figure 5.2: Long term distribution of Lodgepole pine as modelled using methods discribed in section 1.

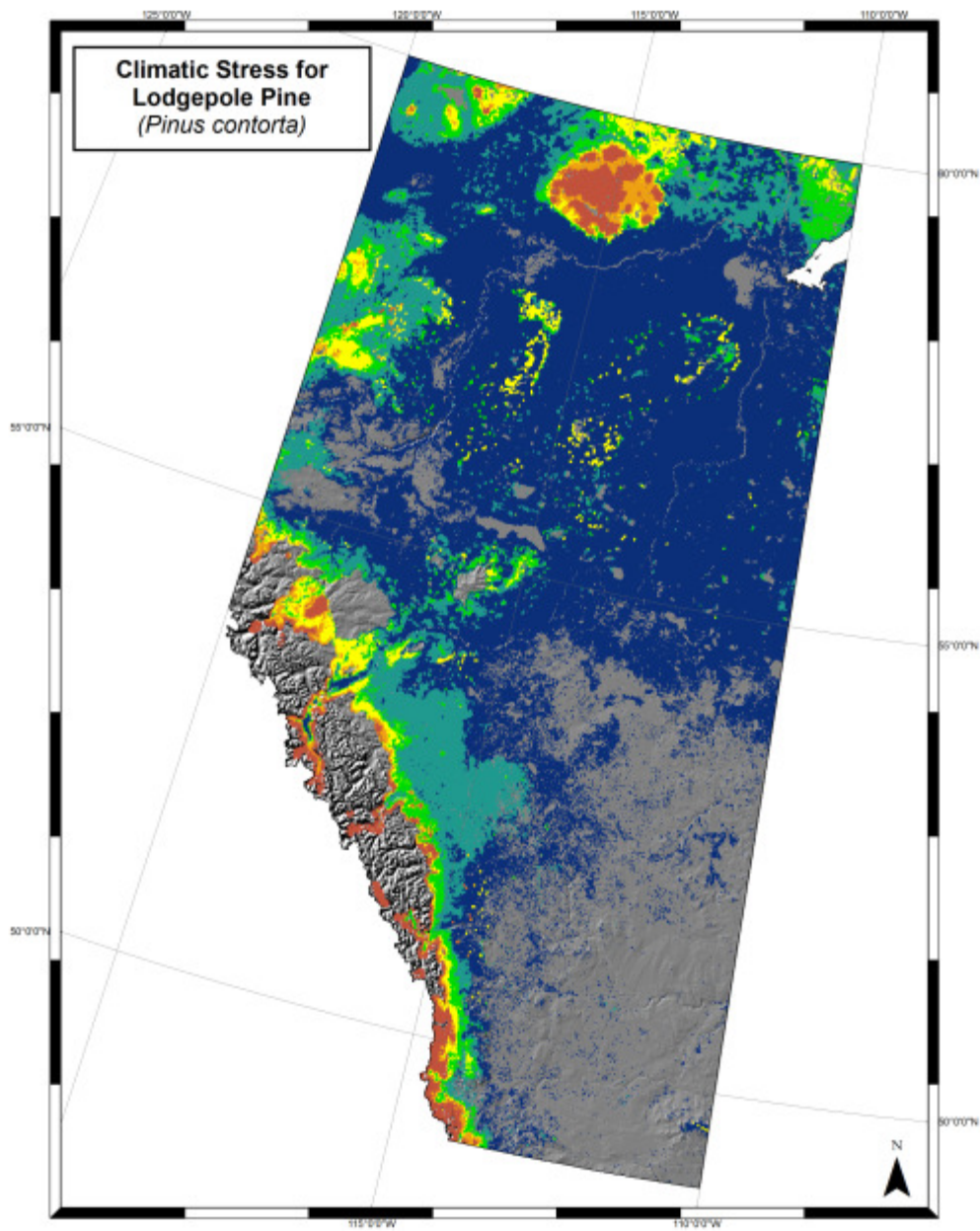


Figure 5.3: Predicted stress of Lodgepole pine as modelled using methods described in section 1.

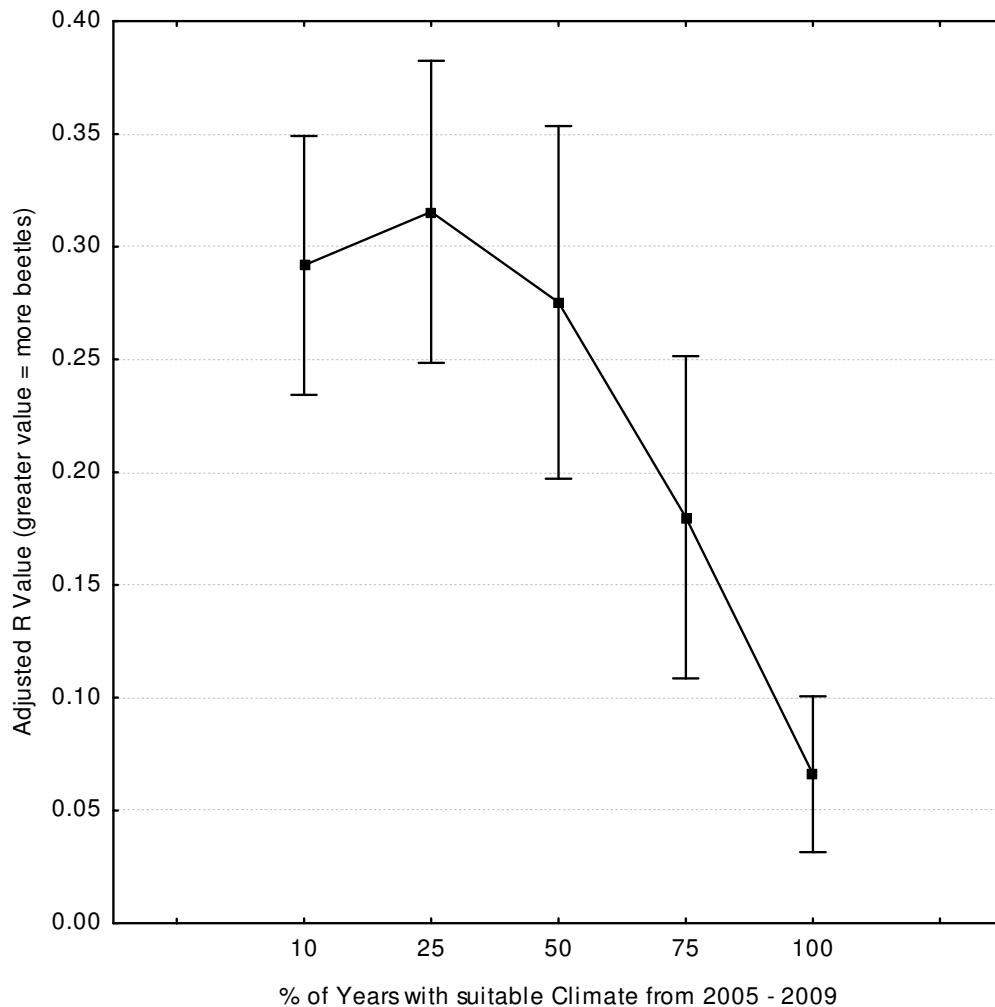


Figure 5.4: Relationship between years unsuitable for lodgepole pine between 2005 and 2009, and adjusted r values.

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