UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

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Escuela Nacional de Estudios Superiores, Unidad Morelia

RESPUESTAS DE LA POLÍTICA PÚBLICA PARA LOS BROTES DE ESCARABAJO DESCORTEZADOR EN EUA OESTE: UN ANÁLISIS DEL NEXO ENTRE LA GESETIÓN POLÍTICA

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QUE PARA OBTENER EL TÍTULO DE

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P R E S E N T A

MARLENE LUVIANO PALMERIN

DIRECTOR DE TESINA: DR. JESSE ABRAMS

CO-DIRECTOR: DR. ANDRÉS CAMOU GUERRERO

MORELIA, MICHOACÁN **OCTUBRE, 2015**

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SECRETARÍA GENERAL
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DR. ISIDRO ÁVILA MARTÍNEZ
DIRECTOR GENERAL DE ADMINISTRACIÓN ESCOLAR, UNAM
P R E S E N T E.

Por medio de la presente me permito informar a usted que en la sesión extraordinaria 07 del H. Consejo Técnico de la ENES Unidad Morelia celebrado, el día 08 de agosto del 2015, acordó poner a su consideración el siguiente jurado para el Examen Profesional de la alumno **MARLENE LUVIANO PALMERÍN** con número de cuenta **412023277**, con el trabajo profesional titulado: **"Respuestas de la política pública para los brotes de escarabajo descortezador en E.U.A. oeste: un análisis del nexo entre la gestión política"** bajo la dirección como Tutor del **Dr. Jesse Abrams** de la Universidad de Oregón, E.U. y el Co-tutor, el **Dr. Andrés Camou Guerrero**.

Presidente:	Dr. Diego Pérez Salicrup
Vocal:	Dra. Ek del Val de Gortari
Secretario:	Dr. Andrés Camou Guerrero
Suplente:	Mtra. Carla Patricia Galán Guevara
Suplente:	Dr. Jesse Abrams

Sin otro particular, quedo de usted.

A t e n t a m e n t e
"POR MI RAZA HABLARA EL ESPIRITU"
Morelia, Michoacán a, 27 de agosto del 2015.

DRA. TAMARA MARTÍNEZ RUIZ
SECRETARIA GENERAL

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Muchas gracias a mi universidad UNAM por albergarme estos 3 años, proporcionándome una formación académica integral y de excelente calidad.

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Gracias a mi ahora esposo Kamel quién estuvo conmigo durante todo este proceso, por nunca permitirme dudar de mí. Su amor y amistad hacen de mi vida una experiencia maravillosa.

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A las personas que realizaron un aporte, que se ve reflejado en la culminación de mi paso por la universidad. Muchas gracias a todos ustedes.

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Chapter One: Preface

Preface

This thesis consists of a preface, a central research article, a section of final thoughts about my experience both academic and personal. And finally, the annexes where I include the databases generated for this work.

The preface includes:

- The context in which this work was developed
- What the department I joined briefly does
- The reason I decided to participate in this project in particular
- How I link this topic to my major in Environmental Science

This research paper is a product of my work as a research assistant, for 7 months at the University of Oregon, to fulfill the requirements of my bachelor's degree. I joined a project that was in its initial stage which main objective is "to improve our knowledge of the coupled dynamics of forest governance, climate change, and native insect outbreaks". To explain this general project I transcribed the NSF (National Science Foundation) proposal submitted by Chris Bone, Cassandra Moseley, and other co-workers:

"In recent decades, unprecedented outbreaks of native insects across the forests of the American West have led to the mortality of millions of trees, yet knowledge of what drives these outbreaks remains uncertain. It is known that climate change has broadened the geographic range over which native insects can survive, and some wildfire and forest policies have led to regional landscapes of highly susceptible trees. However, a gap remains in understanding how the dynamic feedbacks between climate change and forest governance have altered the natural cycles of native insects and facilitated outbreaks beyond what has been previously observed, and how the timing and extent of these disturbances impact the ability of governance to adapt and respond to future outbreaks. It is crucial that this gap be addressed due to the ecological, social, and economic consequences of native insect outbreaks in the American West. The objective of our

research is to improve knowledge of the coupled dynamics of forest governance, climate change, and native insect outbreaks. Specifically, we ask, to what degree has climate change versus forest policies altered the timing and spatial extent of native insect outbreaks? How do forest governance systems reorganize to respond to native insect outbreaks? To what degree might different governance arrangements adapt to insect outbreaks that may emerge under the potential range of future climate change scenarios? We will address these questions through the development, testing, and analysis of an agent-based model of the coupled dynamics of forest governance, climate change, and insect outbreaks. Our team is a diverse group of researchers across the social, natural, and computational sciences with expertise in insect outbreaks, forest governance, climate change, agent-based modeling, and high performance computing, all of which will be used to address the CNH system challenges presented by native insect disturbances.
(Bone et al. 2014)

Under the premise that forest management is guided by laws, it is important to understand past trends and future trajectories of forest policy regarding the handling of bark beetles. In this context my involvement in this project consisted in investigating policies related to native insects, specifically the bark beetle, centering in the management options and the policies that regulate them. Also, I sought which laws / legislation was applicable on the mountain pine beetle, analyzing strategies and mechanisms to contain outbreaks.

I remained active in the research project for 7 months and spent 20 hours a week working on the Ecosystem Workforce Program, which is part of the Institute for a Sustainable Environment. As a result of the overall research project, a modeling software will be published with instructions to simulate the interactions between insects and trees, and between different related policies. With the help of my advisors Jesse Abrams and Patrick Bixler, The product of my research activity was an analysis of the problem, its historical context and an analysis of the legal remedies.

To explain what the department I participated in does, I collected this information from their webpage:

"The Ecosystem Workforce Program undertakes research and monitoring about the ecosystem management industry, community-based forestry, federal land management, and the successes and challenges of innovation. They foster strategic policy making and decision making by disseminating the results of their research and monitoring in collaboration with community-based forestry organizations. With collaborators they develop publications with two primary goals: (1) Educating policy makers and practitioners and (2) Contributing to scholarly and practical discourse through dissemination of EWP research. Publications with a policy education goal are found under our Briefing Papers section and are short 2-4 page documents. Working Papers provide the details of EWP research and Other Publications include external publications authored by EWP faculty and colleagues." Ecosystem Workforce Program (2015).

I decided to collaborate in this project on the grounds that I was going to be able to apply the knowledge acquired from my major, as UNAM explains in their webpage the degree in Environmental Sciences started in 2005 with the aim to "*promote the education of people that contribute to understanding and solving environmental problems from an interdisciplinary perspective."* To be more specific on why this is necessary they explain that *"In the analysis of environmental issues is very important to understand the impact social dynamics have on natural processes, the way in which ecological dynamics affect social groups and the feedback generated between social and ecological components of socio-ecosystems"* (ENES 2015). The environmental science field plays a crucial part in any discussion of the relationship between humans and the natural world which sustains us.

The way I can relate this research project with my major is that I had to apply concepts learned in coursework to "real life" situations, I kept on learning about environmental issues and methods, continued to read primary literature and growing as a critical, analytical, and independent thinker. Without reliable data, informed analysis and the ability to forecast, we could not begin to make complex judgements on which our future depends, besides it is increasingly necessary to connect science not just with policy, but to policy development processes. I think that in this context the subject of the research fits perfectly, by studying the policy responses to bark beetle outbreaks we are trying to understand the relationship and the interactions between society and the environment. Also, through research we gather enough information to make management decisions, and hopefully the findings from this analysis contribute to our understanding of policy response to large-scale forest disturbance and provide some insight into the dynamic interplay between forest ecology and forest governance.

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Chapter Two: Research Paper

Public Policy Responses to Mountain Pine Beetle Outbreaks in the U.S West.

An analysis of the policy management nexus.

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Resumen

Una epidemia del escarabajo del pino de montaña (*Dendroctonus ponderosae*) ha causado mortalidad extendida de los árboles de *Pinus contorta* y *Pinus ponderosa* a lo largo del oeste de América del Norte. Los registros históricos indican que los escarabajos de pino de montaña han sido una parte integral de la ecología de los bosques de las Montañas Rocallosas durante muchos siglos, sin embargo, el alcance y la magnitud del brote actual aparentemente no tiene precedentes. Este brote parece estar asociado conjuntamente por factores de estrés a escala del paisaje, tales como el cambio climático y la sequía, así como por decisiones de gestión pasadas y la política forestal. Las respuestas políticas a nivel del Congreso, tanto pasadas y presentes, no necesariamente siguen un camino particular, pero generalmente se pueden clasificar en alguna categoría. Con el fin de evaluar mejor las respuestas políticas a los brotes de escarabajo del pino de montaña, examinamos 57 proyectos de ley presentados en el Senado de los Estados Unidos o de la Cámara de Representantes entre los años 1975 y 2013. De los 32 proyectos de ley que abordaban específicamente el escarabajo de montaña, analizamos el contenido de los proyectos de ley para observar las tendencias y patrones a lo largo de una variedad de dimensiones, incluyendo: qué partido político introdujo el proyecto de ley, el mecanismo de la política recomendada, y los tipos específicos de lenguaje o elementos discursivos, que el proyecto de ley utiliza para conseguir apoyo. En general, encontramos que los proyectos de ley relacionados con el escarabajo del pino de montaña se han incrementado a través del tiempo, que el mecanismo de política preferido en la mayoría de los proyectos de ley fue suspender o modificar la legislación ambiental existente, y la palabra "catástrofe" fue el elemento discursivo más común. Los resultados de este análisis contribuyen a nuestra comprensión de la respuesta política a la perturbación del bosque a gran escala y proporcionan una idea de la interacción dinámica entre la ecología forestal y la gobernanza de los bosques.

Abstract

A mountain pine beetle *(Dendroctonus ponderosae)* epidemic has caused widespread mortality of *Pinus contorta* and *Pinus ponderosa* trees across western North America. Historical records indicate that mountain pine beetles have been an integral part of the ecology of Rocky Mountains forests for many centuries, however the scope and scale of the current outbreak appears unprecedented. The current outbreak appears to be driven jointly by landscape-scale stressors such as climate change and drought, as well as by past management decisions and forest policy. Policy responses at the congressional level, both past and present, do not necessarily follow a particular pathway and generally fall into one of several categorical responses. In order to better assess policy responses to mountain pine beetle outbreaks, we examine 57 bills introduced into the United States Senate or House of Representatives between 1975 and 2013. Of the 32 bills that specifically addressed mountain pine beetle, we analyze the content of the bills for trends and patterns along a variety of dimensions, including: which political party introduced the bill, the recommended policy mechanism, and the specific kinds of language, or discursive elements, the bill uses to build support. In general, we find bills related to the mountain pine beetle increasing over time, the preferred policy mechanism in a majority of the bills was to suspend or alter existing environmental laws, and the word "catastrophe" was the most common discursive element that we found. The findings from this analysis contribute to our understanding of policy response to large-scale forest disturbance and provide some insight into the dynamic interplay between forest ecology and forest governance.

1. Introduction

Dendroctonus ponderosae, or the Mountain Pine Beetle (MPB), as shown in Figure 1, along with several other beetle species, are killing various species of pine trees, including Lodgepole pine (*Pinus contorta*) and Ponderosa pine (*P. ponderosa*), in record numbers and changing the face of the Rocky Mountains from Canada to Mexico. MPB are native to pine forests across the American West and historically their outbreaks have been an integral part of these ecosystems, serving as a natural rejuvenation agent and therefore part of the natural cycle of the forests. However, over the past years the scale of these outbreaks have augmented in such a way that after the mortality of millions of trees, MPB are now considered to be an epidemic, yet science of what drives these outbreaks remains uncertain. Suspected drivers of the epidemic scale of beetle outbreaks are climate change, forest policy, and past management practices including fire suppression.

Figure 1. Mountain Pine Beetle (National Parks Service, 2015)

Forest governance and policy play crucial roles in shaping forest succession and cycles and influencing the capacity of forests to respond to native insects. The purpose of this paper is to identify how congressional legislation has attempted to address MPB outbreaks and analyze the patterns and trends of the federal legislation. This is guided by the research question: how have senators and members of congress framed the issue of MPB impacts on forests and what policy solutions have they proposed?

The results will offer insights into how the political system addresses environmental change and shapes the complex feedback loops between ecological systems and political systems.

2. Mountain Pine Beetles

2.1 MPB biology

The mountain pine beetle is one species of several in the *Dendroctonus* and *Ips* genera known as bark beetles. The adult beetle is roughly the size of a raisin, adults are uniformly black and measure about 55 millimeters long. The MPB's entire life cycle is spent beneath the bark of host trees, except when adults emerge from brood trees and fly in search of new host trees (Gibson et al., 2009).

After attacking the trees, the MPB will feed on the inner bark of the tree (Figure 2) and lay eggs in a "gallery" in mid-to-late summer to allow the eggs sufficient time to hatch and develop to larvae before winter (Safrenyik, 1989). Each female will lay an average of 60 eggs; two weeks later the eggs hatch into larvae. Generally, eggs will develop in one year.

Figure 2. A tree under attack, with vigorous defense of resin exudate from entrance (Real Climate RSS, 2010).

The burrowing beetle also inoculates the sapwood of the host with a blue-stain fungus to feed the larva, interrupting the nutrient flow between the roots and the crown of the tree and causing the tree to die (Waring and Pitman, 1985). The trees begin to dry out in the first couple of years after the infestation, resulting in cracks along the tree bole.

Attacked trees attempt to expel invading beetles by producing large amounts of sap. Beetles either drown in toxic resins, abandon the tree, or successfully reach the inner bark. If a large number of beetles are available to attack a tree within a short time period, even a relatively healthy tree can be overcomed (Gibson et al., 2009). It all begins when a single Female beetle initiates an attack. During the process of chewing into the inner bark and phloem, aggregating pheromones are released, attracting hundreds of male and female beetles so they all can coordinate and attack the same tree to successfully overwhelm the tree's defenses and make it a suitable place to reproduce, which ends up killing the tree. This whole process only takes 3 or 4 days.

2.2 Endemic vs Epidemic dynamics

Large-scale outbreaks have been a common feature of coniferous forests at least since the last glacial retreat about 13,000 years ago (Brunelle et al., 2008). Bark beetles are major natural disturbance agents in western North American forests. However, recent bark beetle population eruptions have exceeded the frequencies, impacts, and ranges documented during the previous 125 years (Raffa et al., 2008). Figure 3 shows this exponential behavior.

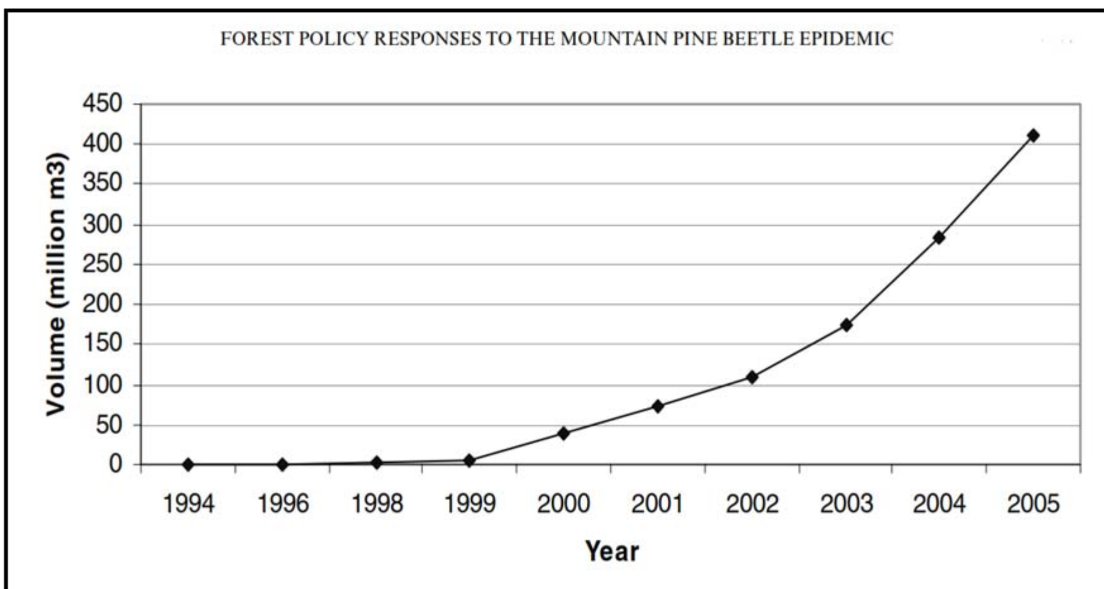

Figure 3. Volume of mature timber killed by the Mountain Pine Beetle (millions of m^3) (Nelson et al.,2007).

The MPB is not an exotic invasive species; to the contrary, it is native to North America and has always been an important part of the health and lifecycle of the forest ecosystem. Pine forests have experienced MPB outbreaks in the past and regenerated, often with renewed vigor. When beetle outbreaks follow normal patterns and occur within the bounds of historical variation, they do not destroy, but rather support a forest's long-term structure, function and resilience.

However, under epidemic conditions, beetles mass-attack mature healthy trees, overcoming tree defenses, and in catastrophic outbreaks can kill trees over hundreds of thousands of hectares (Safranyik et al., 1974), as shown in figure 4.

The drivers of the increased scale of beetle epidemics are complex but they include both climate change and the past history of forest and fire management (Raffa et al., 2008). Increasing temperatures around the globe have increased the survival rates of some native insects, such as MPB, and expanded the range over which they can thrive. In addition, a history of forest policies in the Rocky Mountains region has altered natural forest dynamics in way that has left them more susceptible to outbreaks. Rocky Mountain National Park is just one example of where beetles are killing trees. Beetle outbreaks have occurred in the past, but since the Rocky Mountain National Park was established in 1915, there has never been an outbreak as large as the one currently occurring (Patterson, 2009).

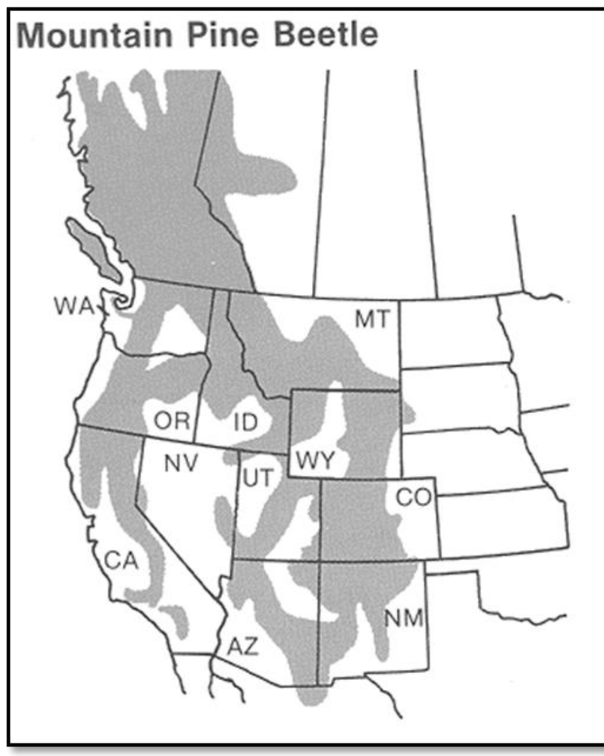

Figure 4. Distribution of the mountain pine beetle in North America (National Parks Service, 2015).

2.3 Effects on forests

As previously mentioned, the MPB has been an integral part of the ecology of Rocky Mountains forests and, generally speaking, ecologists are not worried about the long-term capacity of the forest to persist. Outbreaks are a part of the ecosystem's cycle; but they can still cause social and economic impacts to nearby communities. Economic losses include the value of timber lost for the timber industry as well as the impact on recreational opportunities, tourism, resorts, and other elements of recreational infrastructure. And there are other costs, damages and impacts, such as utility infrastructure damage, power lines, trails, roads, and other ecosystem services (Krista Gebert, 2010).

These outbreaks are also impacting water quality, air quality, and soil stability. These economic and ecosystem service impacts appear to be key in understanding the policy responses to MPB. (Embrey S, et al. 2012)

2.4 Drivers of epidemics: forest management, fire suppression and climate change

Historically, mountain pine beetles were killed during cold winters. One of the drivers leading to the current outbreak is that temperatures are not dropping as low for extended periods of time, leading to a higher survival rate of beetles. Insects are highly sensitive to changes in climate. Their metabolic rate is dictated by ambient temperature, and their activity and development therefore respond strongly to even minor changes in temperature (Volney & Fleming, 2000). Due to climate change, forests are now experiencing warmer summers and winters, shifting MPB outbreaks from endemic to epidemic (Six, 2015).

Forest policy, including past management practices and fire suppression, can be considered as another factor leading to more susceptible weakened trees (Figure 5). These policy decisions have resulted in many forests becoming denser, possibly putting stress on trees and making them less able to fend off beetle attacks, especially in the face of climate change.

Figure 5. Forest damaged by the mountain pine beetle (British Columbia, 2015)

Fire suppression programs have resulted in atypical fuel accumulations, declines in forest health, greater risk to firefighters and increased likelihood of insect and disease epidemics (Sibold et al., 2006). The severity of the current MPB outbreak is linked to fire suppression practices and drought conditions, which are altering forest ecosystems. One consequence of fire suppression is that larger and more contiguous landscapes have become simultaneously susceptible to bark beetles outbreaks with high percentage of old, large diameter, and less vigorous host trees.

2.5 Interactions between beetles and fire

Wildfire and bark beetle outbreaks are the two most important disturbance agents affecting conifer forests of western North America (Raffa et al., 2008), and the incidence of both is rising because of climate change. Fires take hold and spread faster in a warmer, drier climate. Cold winter temperatures used to kill large amounts of beetle larva, and now more beetles are surviving every year to damage more forests.

The risk of fire and insect outbreaks has increased because of fire suppression, overstocked stands, and periods of drought (Campbell et al., 1996). While fire control led to forests becoming overstocked with old, large diameter, and less vigorous host trees, bark beetles began eliminating trees in excess on potential sites and now outbreaks affect larger areas for longer periods and often with greater intensity than historical outbreaks. When fires occur, they are much more severe and kill more trees on each burned acre (Campbell et al., 1996). As shown in Figure 6.

Figure 6. Dead trees provide fuel for forest fires (Cameron, 2009)

Some lodgepole pines survive otherwise stand-replacing fires but are injured. Such fire-injured lodgepole pines may be more susceptible to MPB, even when beetle populations are low (Powell et al., 2012). High-severity fires generally give rise to young lodgepole stands that may be less susceptible to MPB outbreaks (Kulakowski et al., 2011), but surviving trees may be weakened and subsequent outbreaks may be increased.

For a long time it was believed that beetle damaged forests were more likely to burn than green forest because they looked drier, but research now indicates that the attacked trees have little to no effect on fire. In fact, in some instances they may even reduce the risk of fires because after the attack the canopy fuel loads are reduced (Simard et al. 2011; Romme, 2006).

The specific impacts of beetle infestations on fire risk vary between studies, in part because of differences in the factors that are included in the various computer models, and in part due to different results from field surveys of how infestation has affected fuel loads in infected areas (Foster, 2012). Bark beetle outbreaks and wildfire occurrence are both predicted to increase with continued climate warming in North America (Bentz, et al. 2010) and worldwide. While the effects of fire and MPB may be individually severe, extremely dry, gusty, hot weather conditions are key factors in determining both fire and the susceptibility of the forest to MPB (Schoennagel, 2012).

2.6 Recommended management practices

There are various management options for the Mountain Pine Beetle: 1) short-term prevention techniques, aimed at manipulating beetle populations; 2) long-term prevention techniques targeted at the stand and landscape; and 3) restoration of affected landscapes.

Fire is an important way to manage, in order to mimic natural disturbance. One of the most effective, although expensive, is to cut and burn individual beetle-infested trees in order to protect nearby trees. Another tool is burning or logging large areas trying to create boundaries to keep beetles from crossing. Pheromone traps can also be used to attract the beetles to one place and manage it, or to keep the beetles away from certain areas. Preventive spraying of insecticides is a small-scale solution, for example around homes in the middle of the forest (Figure 7).

Figure 7. Spraying has been effective in protecting high value trees in the parks. (National Parks Service, 2015)

As for long-term management, one possible approach is burning and logging susceptible pine to prevent having a homogenous forest. The goal of thinning is to reduce stand density to increase the growth rate and improve the health and vigor of individual trees.

The Rocky Mountain area consists of a patchwork of federal, state, and privately owned and managed lands, but federal lands predominate. Forest health managers need to develop maximum flexibility regarding policy in order to identify the best and most efficient ways to address forest condition and bark beetle concerns, since policies can have a major influence on how forests are managed; more so given that federal land dominates within the range of the MPB. Any given management action is largely shaped by federal land management policy.

3. Methodology

In order to analyze the policy response to mountain pine beetle outbreaks, we searched for bills introduced in either the U.S. Senate or the U.S. House of Representatives that addressed the MPB in some way. In order to search for bills, we used the following two-step search process. First, we searched the ProQuest Congressional database, which archives electronic versions of all bills introduced into Congress since 1789 including their pdf text. To cross-check what we found and to make sure we found everything, we also searched the Congress.gov database, which archives all congressional legislation introduced since 1993 with full text and sponsorship information going back to 1981. The same search terms were applied to both databases. The terms searched were:

- "Mountain pine beetle"
- "Pine beetle"
- "Bark beetle"
- "Dendroctonus ponderosae".

For the ProQuest search, we limited the search to only “Bills and Laws”, then limited to “Bill profiles” and then filtered it once again to include only the “Bill Profiles”. For Congress.gov we limited the search to “legislation”. We searched for these terms in all fields, including full text. For every bill we identified, we downloaded the most recent version (i.e., the version that had most recently been considered in the House or Senate, including any revisions).

We reviewed the text of each bill to ensure that it did in fact address the mountain pine beetle, which was a necessary step given that our search terms picked up legislation that addressed other bark beetles such as those active in the U.S. South or Alaska. We then developed a coding strategy based on the existing literature and emergent patterns of initial reviews of bills. We coded the bills in terms of party sponsorship, how far the bill advanced, proposed policy solutions, narrative elements and spatial / administrative scale.

We developed 4 categories for proposed policy solutions. These included: “provide funding”, “require action”, “suspend/alter existing laws”, and “expand or link to existing management authorities”. We also included subcategories for each of these categories. For example, under the category of “Providing funding” we specified the subcategories “provide funding for competitive research,” “provide funding for agency research,” etc.

Any given bill could be coded for multiple categories as well as multiple sub categories; this was common given that any single bill typically included multiple proposed policy solutions. For example, if the policy action in the bill was to provide funding, it could include both funding for competitive research as well as funding for forest treatments. Coding decisions were made through a collaborative process wherein all 3 researchers reviewed each bill at the same time and came to consensus on how to code the bill.

4. Results and Discussion

In total, we found 57 bills that fit within the parameters mentioned above. We were able to access and download 55 of the bills, and discovered that 32 were actually about mountain pine beetles (and the others were about other kinds of beetles, e.g., Alaskan Spruce Beetle or the Southern Pine Beetle). Of the 32 we analyzed in more depth, 4 became law, 2 additional bills were passed by one house but not the other, and 26 were not passed by either house.

Table 1 shows the bills that were passed into law. Notice that the first 2 bills that became law were from Democrats in 1986 and 1988, and then 15 years later Republicans passed two additional bills into law, both in the 108th Congress. Three of the four passed bills were appropriations legislation in which MPB language was included, meaning that only one stand-alone bill specifically addressing the MPB has been passed by Congress as of the time of this analysis (March 2015).

Table 1. MPB Bills that became law

Year	Congress	Bill Number	Name of bill	Sponsoring Party
1986	99	H. J. Res. 738	Making continuing appropriations for fiscal year 1987	D
1988	100	H.R. 4784	Making Appropriations for Rural Development, Agriculture and Related Agencies programs for the fiscal year ending September 30, 1989, and for other purposes	D
2003	108	H. J. Res. 2	Consolidated appropriations Resolution, 2003	R
2003	108	H.R 1904	Healthy Forests Restoration Act of 2003	R

The first two bills (H.J. Res. 738 and H.R. 4784) that became law provided funding for competitive research. The third, approved in 2003 (H.J. Res. 2), provided funding for post-infestation treatment of beetle-affected forests. The last bill that passed was the Healthy Forests Restoration Act (H.R. 1904). It provided funding and required action for developing plans/ programs as well as for developing new treatment or monitoring methods. It also suspended/ altered existing environmental laws.

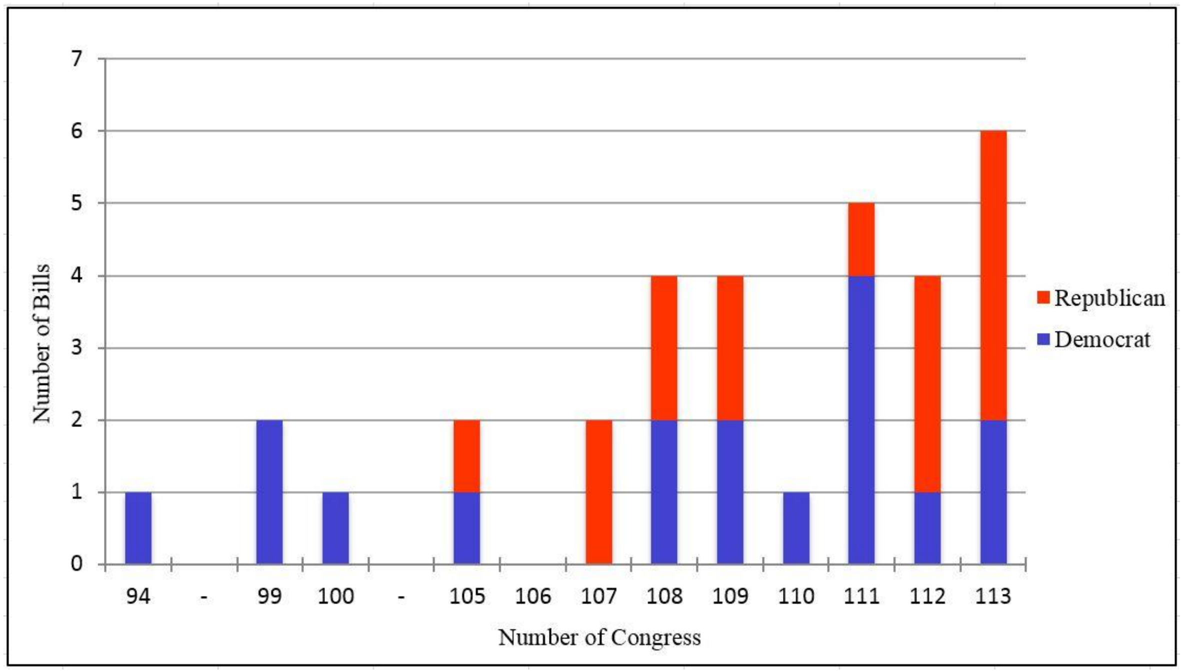

Figure 8. Showing sponsored bills by parties through the congresses

As figure 8 illustrates, the first bill found that addressed Mountain Pine Beetles was in the 94th Congress (1975-76). The next bill didn't occur until the year of 1986, (99th Congress), which proposed 2 bills related to MPB; another one was introduced in the 100th Congress. The 105th Congress had one Republican and one Democrat sponsored bill, and in the 107th Congress there were two Republican sponsored bills. Starting in 2001, bills addressing the MPB were being consistently introduced.

Of these 32 bills, 17 of them were introduced by Democrats and 15 were introduced by Republicans. In 1975 Democrats were the only ones introducing bills related to MPB; this was true for the next 22 years until 1997. Starting in the 105th Congress, Republicans started taking increasing action; in the 113th Congress Republicans sponsored four MPB related bills. In general we observe a tendency of more bills being introduced, perhaps because over time this beetle issue has become more and more noticeable until the point that it can't be ignored. Over time, the specific policy tools being proposed have changed, as Figure 9 illustrates.

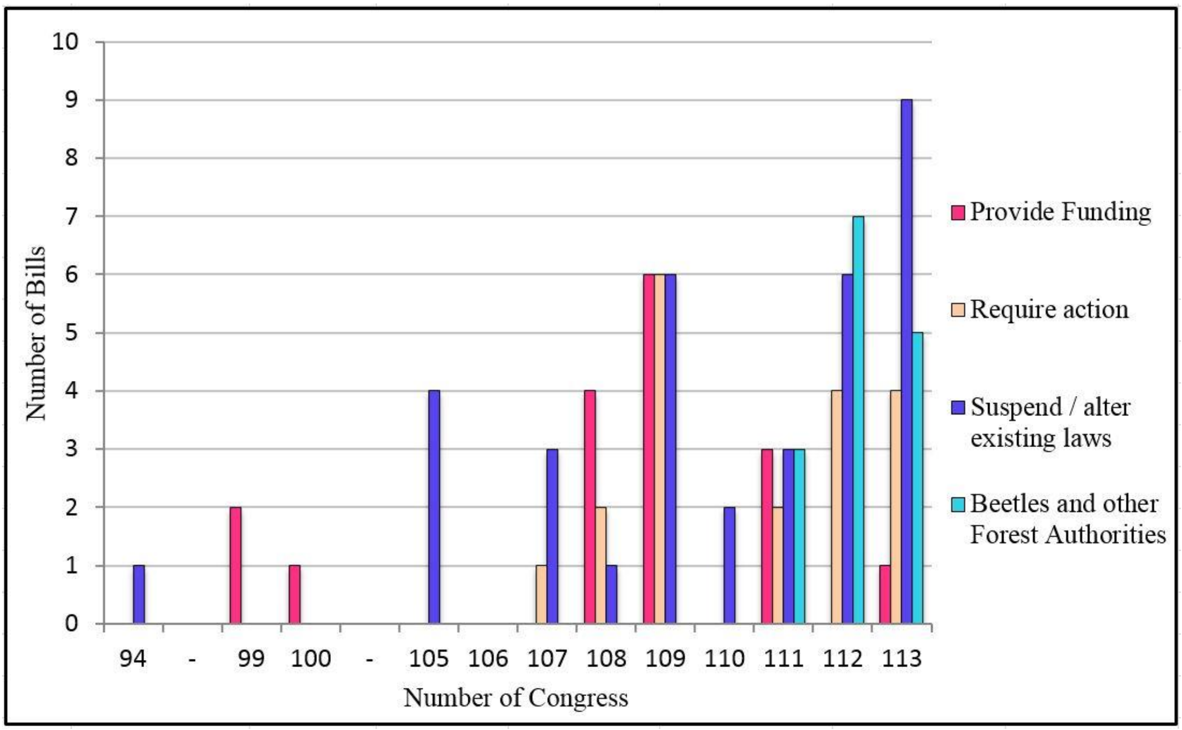

Figure 9. Main topics of the bills

We can observe in Figure 9 that, in general, bills related to Mountain Pine Beetles shifted over time from proposing to spend money on the problem to mostly revising or limiting the scope of existing laws. The MPB related bill introduced in the 94th Congress proposed suspending or altering existing laws, and that has consistently been a favored policy tool. The 113th Congress suggested it in various forms nine different times. The laws proposed for suspension or alteration were almost always those associated with public process or environmental protection, such as the National Environmental Policy Act of 1969 (NEPA) and the Endangered Species Act of 1973 (ESA).

Starting in 2009, the 111th Congress began to link MPB bills with other existing forest authorities such as Stewardship Contracting and Good Neighbor Authority. The bills that require some kind of action have a strong presence and we can observe that they have become more common recently.

Table 2. Bills providing funding

Policy tool	**# of Bills**
Provide funding	15
- For competitive research	7
- For agency research	0
- For treatment of beetle active outbreaks	1
- For treatment of beetle-effect forests (after the fact)	1
- For private businesses (loans/ grants)	5

In total we found 15 bills that provided funding, meaning that, of the 32 bills, 47% of them proposed providing funding in order to address beetle impacts. Of those the majority proposed funding for competitive research. We can see in Figure 9 that the bills that provide funding were more common in the early part of the analysis period and became less common over time.

Of the 15 bills that provided funding, funding for competitive research had the highest frequency of occurrence, appearing in seven bills. Loans and grants to private businesses appeared five times.

As Table 3 indicates, 53% of the bills proposed to require some kind of action, with the majority requiring action for developing plans/ programs, an equal distribution between implementing existing programs and requiring/ allocation of existing funds and only one bill introduced for developing new treatment or monitoring methods.

Table 3. Bills requiring action	
Policy tool	**# of Bills**
Require Action	17
- Develop plans/ programs	9
- Develop new treatment or monitoring methods	1
- Implement existing program	5
- Requires /allocation of existing funds	5

Suspending / altering existing laws was the most common policy tool we found in our set of MPB bills, with 21 of the 32 bills (66%) containing this action. We found that bills proposing to suspend or alter existing laws have increased over the years, most recently with 6 bills introduced in 2009 by the 112th Congress, and 9 bills introduced in 2013 by the 113th Congress. Most of these suggest suspending or limiting the scope of environmental laws and/ or public disclosure and public process laws. The National Environmental Policy Act of 1969 (NEPA), which requires the analysis and disclosure of environmental effects and additionally requires public involvement in decision-making, was a particularly common target of these kinds of bills.

Table 4. Bills that suspend or alter existing laws	
Policy tool	**# of Bills**
Suspend/ Alter existing laws	21
- Environmental laws	18
- Public disclosure/ process laws	15
- Hiring laws	1

Beginning in 2009, legislation started linking action on beetles to other existing legislation, including permanent authority for stewardship contracting and good neighbor authority, both tools the Forest Service uses to accomplish work on the land as part of the Healthy Forests Initiative to conduct restoration and to achieve broad land management goals. The Healthy Forests Initiative is separate from the two named policies, even though they are used in conjunction quite often.

Table 5. Bills that combined beetles with other forest authorities	
Policy tool	**# of Bills**
Beetles combined with other forest authorities	9
- Stewardship contracting	9
- Good Neighbor Authority	8

Figure 10 presents the frequency of four key words that imply particular causal narratives related to the causes and consequences of MPB epidemics. The term “epidemic” appeared 8 times in total, “emergency” occurred a total of 14 times, and terms associated with fire risk appeared a total of 22 times. These terms were often used in concert with bills that proposed suspending or limiting the application of existing laws, providing a narrative justification for these kinds of policy tools. Acknowledgement of climate change as a contributor to MPB dynamics was rare, appearing a total of three times in the 32 bills. The trends of these discursive elements over time are illustrated below.

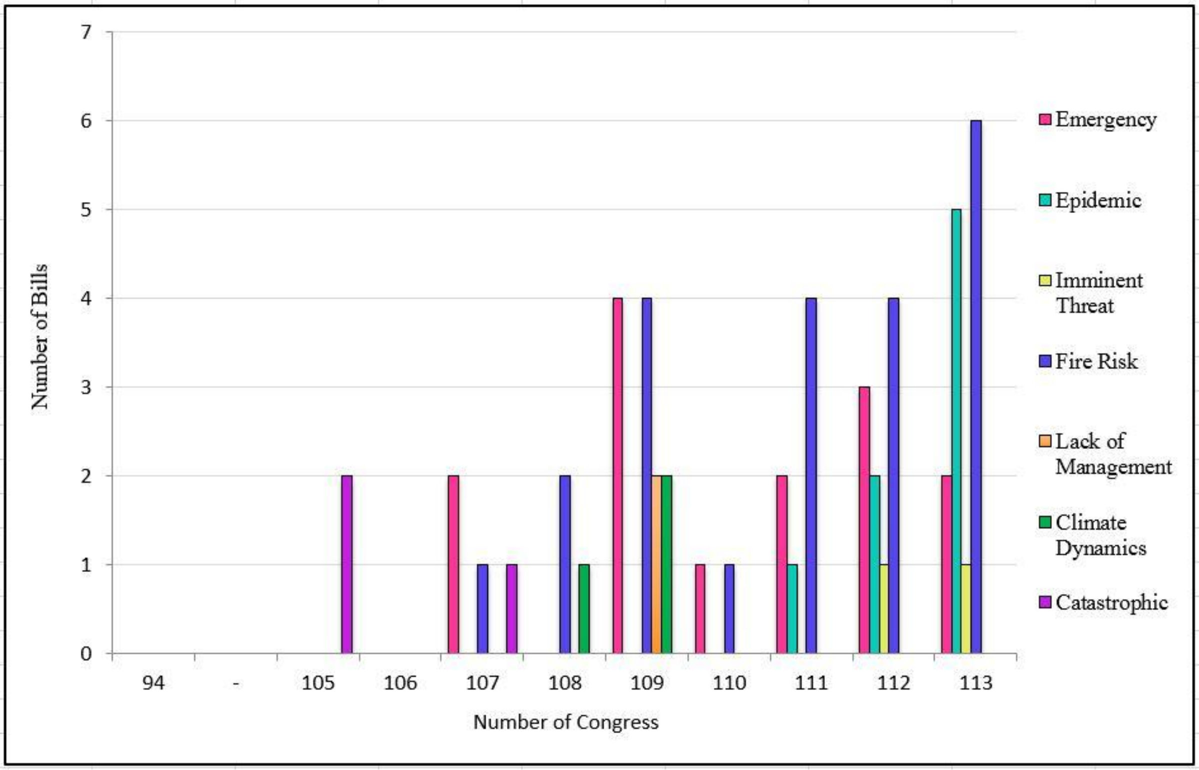

Figure 10. Specific language found in bills.

Some interesting trends emerge over time with the frequency of specific language found in bills. For example, references to a linkage between MPB and increased fire risk has been increasing steadily over the past several congresses. We can observe that, in general, the use of this important terminology when addressing pine beetles has had a tendency to increase perhaps following the pattern of the increased introduction of bills along the years.

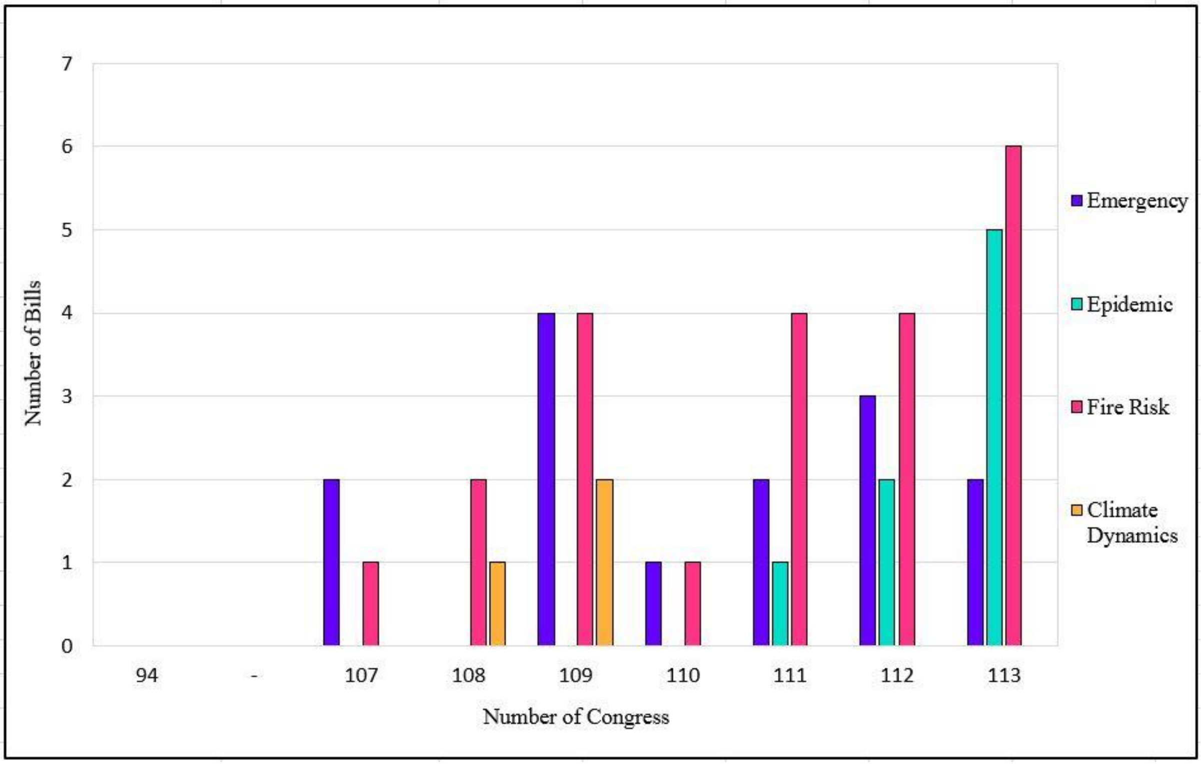

Figure 11. Concurred Specific language used compared with fire risk

As figure 11 illustrates, climate dynamics were not mentioned much in the bills, despite the general scientific understanding that climate is an important driver of the outbreaks (Bentz, et al. 2010). Instead of climate, we found the use of language such as emergency, epidemic, and fire risk increase over time. With the increasing use of these high impact words like catastrophe and crisis we can't help to notice that there isn't an increase and acknowledgment of climate as a driver, yet is a well-known driver of the issue, whereas fire risk does show with a lot more frequency even though the scientific evidence linking MPB to increased fire risk is weak or nonexistent (Schoennagel, 2012).

Finally, we analyzed each bill in terms of whether it applied to a specific geographic, administrative, or spatial scale (e.g., a state, multiple states, or a specific Forest Service Administrative Unit). Almost half of the bills, or 43.7%, specified a geography. Three bills specified a state, in all cases it was Colorado. Six bills applied to multiple States and they were: Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington and Wyoming.

5 bills applied to a specific Administrative Unit. Those included: San Bernardino National Forest; Dixie National Forest, Utah / Panhandle National Forest, Nez Perce National Forest, and Boise National Forest, Idaho; Beaver Park Roadless Area and the Norbeck Wildlife Preserve of the Black Hills National Forest; and Routt National Forest, Colorado.

5. Conclusions

To answer the research questions that started this paper and based on the results presented in: How do senators and members of congress frame the issue of MPB impacts on the forests of the western U.S. and what policy solutions do they propose?

This paper has analyzed the patterns and trends of the federal legislation and it has been documented that the number of bills introduced related to the MPB have been increasing over time, which makes it apparent that the MPB outbreak in the western U.S. has triggered attempts at policy reform. Actual reform of policy has been limited but the number of bills proposed indicates that MPB attacks have attracted the attention of policymakers. The commonest action taken by the policy makers was to suspend or alter an existing law to deal with the MPB outbreaks.

Bills were entered only by Democrats up until the 105^{th} congress (1997-1998). After that, the bills entered were mostly from Republicans, and the shift from bills that provided funding to bills that suspended or alter existing laws is noticeable, where as previously we didn’t see those patterns when the Democrats were in control. This pattern can be explained by the fact that Republicans had greater control of congress beginning with the 104^{th} congress (1995-1996), giving them greater opportunities to move their own agenda focused on cutting regulations and pushing back against environmental protections on federal lands.

We observed selected use of science in these bills. Although climate change has been identified by scientists as a catalyst in the MPB outbreaks by making conditions more hospitable for the beetles, this relationship was rarely recognized in the bills analyzed here. Much more common in these bills were claims of connections between beetles and fire risks, despite the fact that these relationships have not been well established by scientists. One interpretation might be that the MPB problem has been enrolled in a much larger political discourse in which the solution and the framings are prior to the actual ecological problem itself. In this case, MPB policy may be seen as a subset of a larger campaign to reduce the application of environmental and procedural laws on public forestlands in the name of improved ecological health. This helps to explain the increasing use in these bills of terms such as “catastrophic,” “epidemic,” and “emergency” as means of justifying the suspension or weakening of traditional environmental protections.

It is also worth observing that, despite 32 MPB-related bills having been introduced into congress, only four became law. Further, all but one of those that did become law were appropriations bills to which beetle language was added, rather than stand-alone environmental management bills. This highlights the difficulty of advancing forest management legislation in the current U.S. political climate and the sharp disagreements between Republicans and Democrats regarding the causes and preferred policy remedies of the MPB outbreak.

This research project gives us some insight into how the US political systems deal with complex environmental problems such as the bark beetles and even though it got a lot of political attention relatively little changed, and what did change did not seemed to be well informed by the science. This analysis contributes to our understanding of policy response to large-scale forest disturbance, as well as into the dynamic interplay between forest ecology and forest governance.

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Figure 1. Mountain Pine Beetle

Image from: United States. National Park Service. "Forest Health: Mountain Pine Beetle." National Parks Service. U.S. Department of the Interior, 20 Sept 2015. Available at: http://www.nps.gov/romo/learn/nature/mtn_pine_beetle_background.htm. Accessed September 2015.

Figure 2. A tree under attack, with vigorous defense of resin exudate from entrance holes.

Image from: Mountain Pine Beetle. Seeing Red." Real Climate RSS 2010 ". Available at: http://www.realclimate.org/index.php/archives/2010/10/seeing-red/#sthash.rxCgXr88.dpuf. Accessed September 2015.

Figure 3. Volume of mature timber killed by the Mountain Pine Beetle (millions of m^3).

Image obtain from: Nelson, H. (2007). Does a crisis matter? Forest policy responses to the mountain pine beetle epidemic in British Columbia. Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie, 55(4), 459-470.

Figure 4. Distribution of the mountain pine beetle in North America.

Image from: United States. National Park Service. "Forest Health: Mountain Pine Beetle." National Parks Service. U.S. Department of the Interior, 20 Sept 2015. Available at: http://www.nps.gov/romo/learn/nature/mtn_pine_beetle_background.htm. Accessed September 2015.

Figure 5. Forest damaged by the mountain pine beetle

Image from: "Photos." Mountain Pine Beetle, British Columbia, 2015. Available at: https://www.for.gov.bc.ca/hfp/mountain_pine_beetle/bbphotos.htm Accessed September 2015.

Figure 6. Dead trees provide fuel for forest fires

Strandberg, Cameron. "DSC_7139." Flickr. Yahoo!, June 2009. Available at: https://www.flickr.com/photos/38449766@N03/3603009008 Accessed September 2015.

Figure 7. Spraying has been effective in protecting high value trees in the parks.

Image from: United States. National Park Service. "Forest Health: Mountain Pine Beetle." National Parks Service. U.S. Department of the Interior, 20 Sept 2015. Available at: http://www.nps.gov/romo/learn/nature/mtn_pine_beetle_background.htm. Accessed September 2015.

Figure 8. Showing sponsored bills by parties through the congresses

Figure 9. Main topics of the bills

Figure 10. Specific language found in bills.

Figure 11. Concurred Specific language used compared with fire risk

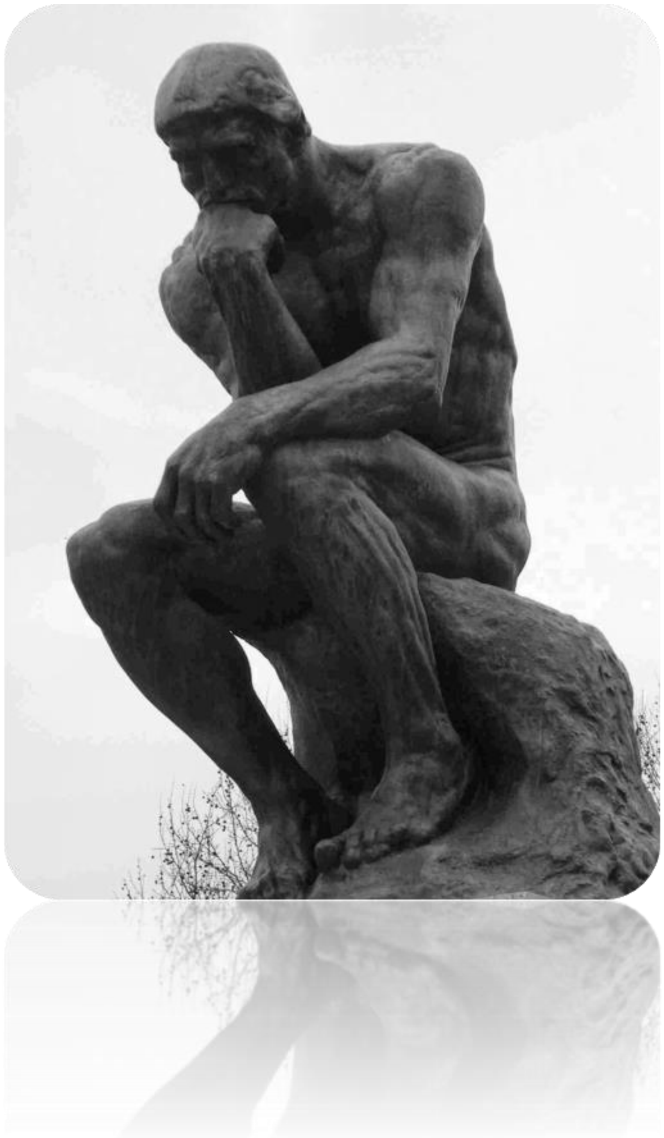
Annexes

Congres	Bill Number	Name of bill	Who sponsored it (Name)	Partty affiliation (DRT)	Bipartisan cosponsor (Y/N)	Summary	Year intoduced	Year of last action	How far it got	
68	H.R. 7220	Appropriations for the I	Sydney Anderson	R	0	Making appropriati	1924	1924	4	PQ
94	S. 1146	Intensified forest impro	James George Abourezk	D	0	To provide for the	1975	1975	1	B
97	H.R. 6157	Urgent Supplemental Ap	Jamie Lloyd Whitten	D	Y	Making urgent supp	1982	1982	1	B
99	H.R. 3037	Appropriations for Agri	Jamie Lloyd Whitten	D	0	A bill making appro	1985	1985	1	PQ
99	S. 2782	Designate the Sipsey Riv	Howell Thomas Heflin	D	0	A bill to designate t	1986	1986	1	PQ
99	H. J. Res. 738	Appropriations for the f	Jamie Lloyd Whitten	D	0	Joint resolution ma	1986	1986	4	PQ
100	H.R. 1827	Appropriations for the f	Jamie Lloyd Whitten	D	0	A bill making suppl	1987	1987	4	PQ
100	H.R. 4784	Appropriations for Rura	Jamie Lloyd Whitten	D	0	A bill making appro	1988	1988	4	PQ
100	S. 2838	Designate the Sipsey Riv	Howell Thomas Heflin	D	Y	A bill to designate t	1988	1988	1	PQ
100	H.R. 5395	Designate the Sipsey Riv	Ronnie Gene Flippo	D	N	A bill to designate t	1988	1988	4	PQ
101	H.R. 3950	FOOD & AGRICULTURA	Eligio (Kika) De La Garz	D	Y	A bill entitled the F	1990	1990	2	PQ
101	S. 2830	FARM BILL	Patrick Joseph Leahy	D	0	An original bill to e	1990	1990	4	PQ
103	H.R. 3233	SOUTHERN PINE BEET	Charles Wilson	D	Y	A bill to require the	1993	1994	1	B
104	H.R. 689	To require the Secretar	Charles Wilson	D	0	A bill to require the	1995	1995	1	B
105	H.R. 2107	Department of the Inter	Ralph Straus Regula	R	0	A bill making appro	1997	1998	4	B
105	H.R. 4345	To authorize the contin	Helen P. Chenoweth-Ha	D	Y	A bill to authorize	1998	1998	1	B
105	H.R. 4570	Omnibus National Park	James Vear Hansen	R	0	A bill to provide fo	1997	1998	1	B
106	H.R. 1524	Public Forests Emergen	Helen P. Chenoweth-Ha	R	Y	A bill to authorize	1999	2000	1	B
106	H.R.2466	Department of the Inte	Ralph Regula	R	0	Appropriates funds	1999	2000		CG
107	H.R. 2216	Supplemental Appropri	Charles William (Bill) Y	R	0	A bill making suppl	2001	2002	4	B
107	S. 1077	Making supplemental ap	Robert Carlyle Byrd	D	0	An original bill mal	2001	2001		PQ
107	H.R. 4766	Black Hills National Fo	John Thune	R	N	A bill to declare the	2001	2002	1	B
107	H.R. 5319	Healthy Forests and Wi	Scott McInnis	R	N	A bill to improve th	2001	2002	1	B
108	H. J. Res. 2	Continuing appropriatic	Charles William (Bill) Y	R	0	A joint resolution m	2003	2004	4	B
108	H.R 1904	Healthy Forests Restora	Scott McInnis	R	Y	An Act. To improve	2003	2004	4	B
108	S.1314	Collaborative Forest He	Jeff Bingaman	D	N	Collaborative Fores	2003	2004	1	CG
108	S.1453	Forestry and Communit	Patrick J. Leahy	D	N	Forestry and Comm	2003	2004	1	CG
108	S. 1938	Act to Save America's F	Jon Stevens Corzine	D	N	A bill to amend the	2003	2004	1	B
108	H.R. 5312	Act to Save America's F	Anna Georges Eshoo	D	Y	A bill to amend the	2003	2004	1	B
109	H.R. 2744	Agriculture, Rural Deve	Henry Bonilla	R	0	A bill making appro	2005	2006	4	B
109	S. 1897	Act to Save America's F	Jon Stevens Corzine	D	N	A bill to amend the	2005	2006	1	B
109	H.R.4875	Rocky Mountain FIRES	Mark Udall	D	N	Rocky Mountain Fo	2005	2006	1	CG
109	S.2584	Rocky Mountain Forest	Ken Salazar	D	0	Rocky Mountain Fo	2005	2006	1	CG
109	S. 2604	Headwaters Protection	A. Wayne Allard	R	0	A bill to address th	2005	2006	1	B
109	H.R. 5305	Headwaters Protection	Marilyn N Musgrave	R	N	A bill to address th	2005	2006	1	B
109	H.R. 6237	Act to Save America's F	Anna Georges Eshoo	D	Y	A bill to amend the	2005	2006	1	B
110	H.R.5241	Colorado Forest Insect	Mark Udall	D	N	Colorado Forest In	2007	2008	1	CG
110	H.R. 7090	Act to Save America's F	Anna Georges Eshoo	D	Y	A bill to amend the	2007	2008	1	B
111	S. 1713	Water Efficiency via Ca	Harry Reid	D	Y	A bill to establish l	2009	2010	1	B
111	H.R. 3748	Water Efficiency via Ca	Shelley Berkley	D	N	To establish loan gu	2009	2010	1	B
111	S.2798	National Forest Insect a	Mark Udall	D	Y	National Forest Ins	2009	2010	1	CG
111	H.R.4398	National Forest Insect a	John Salazar	D	Y	National Forest Ins	2009	2010	1	CG
111	H.R. 5192	Forest Ecosystem Reco	Cynthia M. Lummis	R	N	A bill to require the	2009	2010	1	B
112	H.R. 1408	Southeast Alaska Native	Donald Edwin Young	R	Y	A bill to provide fo	2011	2012	1	B
112	H.R. 4331	National Forest Emerge	Kristi Noem	R	N	A bill to respond to	2011	2012	1	B
112	S. 2277	National Forest Emerge	John Thune	R	N	A bill to respond to	2012	2012	1	B
112	H.R. 2578	Conservation and Econ	Jeff Denham	R	Y	A bill to amend the	2011	2012	2	B
112	H.R. 5960	Depleting Risk from Ins	Edward John Markey	D	N	A bill to amend the	2012	2012	1	B
112	H.R. 6089	Healthy Forest Manager	Scott Tipton	R	N	A bill to address th	2012	2012	1	B
112	S. 3240	Agriculture Reform, Foo	Deborah Ann Stabenow	D	Y	An original bill to r	2011	2012	2	B
113	S. 10	Agriculture Reform, Foo	Harry Reid	D	N	A bill to reauthoriz	2013	2014	1	B
113	H.R. 818	Healthy Forest Manager	Scott Tipton	R	N	A bill to address th	2013	2013	1	B
113	H.R. 1442	Depleting Risk from Ins	Edward John Markey	D	0	A bill to amend the	2013	2014	1	B
113	H.R. 1895	National Forest Emerge	Kristi Noem	R	0	A bill to respond to	2013	2014	1	B
113	H.R. 740	Southeast Alaska Native	Donald Edwin Young	R	Y	A bill to provide fo	2013	2014	1	B
113	H.R. 1526	Restoring Healthy Fore	Doc Hastings	R	N	A bill to restore em	2013	2014	2	B
113	H.R. 4	Jobs for America Act	David Lee Camp	R	N	A bill to make revis	2013	2014	2	B

	Congres	Bill Numb	Name of bill	Partty af	Summary	Year	Beetle Content
4	68	H.R. 7220	Appropriations for the I	R	Making appropriatio	1924	(26) WESTERN PINE BEETLE AND ASSOCIATED I
1	94	S. 1146	Intensified forest impro	D	To provide for the e	1975	A BILL To provide for the employment of unemploye
1	97	H.R. 6157	Urgent Supplemental Ap	D	Making urgent supp	1982	DEPARTMENT OF AGRICULTURE OFFICE OF THE SEC
4	99	H. J. Res. 738	Appropriations for the f	D	Joint resolution mak	1986	In page #393 the resolution notes that House bill 9
1	99	H.R. 3037	Appropriations for Agri	D	A bill making appro	1985	Pine bark beetle gets 1000 thousand dollars for co
1	99	S. 2782	Designate the Sipsey Riv	D	A bill to designate tl	1986	(c) Notwithstanding the provisions of this Act or o
4	100	H.R. 1827	Appropriations for the f	D	A bill making supple	1987	It is a supplemental appropriation
4	100	H.R. 4784	Appropriations for Rura	D	A bill making appro	1988	In page #16 the resolution notes that House bill 95
4	100	H.R. 5395	Designate the Sipsey Riv	D	A bill to designate tl	1988	(c) FIRE, INSECT, AND DISEASE CONTROL.—Cons
1	100	S. 2838	Designate the Sipsey Riv	D	A bill to designate tl	1988	(c) Consistent, with section 4(d)(1) oi the Wildern
4	101	S. 2830	FARM BILL	D	An original bill to ex	1990	NO FULL TEXT AVAILABLE
2	101	H.R. 3950	FOOD & AGRICULTURA	D	A bill entitled the Fo	1990	NO BARK BEETLE TEXT FOUND
1	103	H.R. 3233	SOUTHERN PINE BEET	D	A bill to require the	1993	To require the Secretary of Agriculture to take such a
1	104	H.R. 689	To require the Secretary	D	A bill to require the	1995	A BILLTo require the Secretary of Agriculture to take
4	105	H.R. 2107	Department of the Inter	R	A bill making appro	1998	NO INFO ABOUT BARK BEETLE
4	105	H.R. 2107	Department of the Inter	R	A bill making appro	1997	STATE AND PRIVATE FORESTRYFor necessary exp
1	105	H.R. 4345	To authorize the contin	D	A bill to authorize tl	1998	SEC. 2. WAIVER OF NEPA REQUIREMENTS FOR TREAT
1	105	H.R. 4570	Omnibus National Parks	R	A bill to provide for	1997	SEC. 1009. EAST TEXAS BLOWDOWN-NEPA PARITY.(a)
1	106	H.R. 1524	Public Forests Emergen	R	A bill to authorize tl	1999	SEC. 3. REQUEST FOR EXPEDITED TREATMENT OF DEA
	106	H.R.2466	Department of the Inte	R	Appropriates funds	1999	NO BARK BEETLE TEXT FOUND
4	107	H.R. 2216	Supplemental Appropria	R	A bill making supple	2001	STATE AND PRIVATE FORESTRYFor an additional
1	107	H.R. 4766	Black Hills National For	R	A bill to declare the	2001	SEC. 2. USE OF EXPEDITED ALTERNATIVE PROCESSES T
1	107	H.R. 5319	Healthy Forests and Wil	R	A bill to improve th	2001	TITLE III—IMMEDIATE COMMUNITY PROTECTION ASS
	107	S. 1077	Making supplemental ap	D	An original bill mak	2001	NO BARK BEETLE TEXT FOUND
4	108	H. J. Res. 2	Continuing appropriatio	R	A joint resolution m	2003	H. J. Res. 2—505Public Law 106–74 for a pilot pro
4	108	H.R 1904	Healthy Forests Restora	R	An Act. To improve	2003	TITLE IV—INSECT INFESTATIONS ANDRELATED
1	108	S.1314	Collaborative Forest He	D	Collaborative Fores	2003	SEC. 4. INSECT INFESTATIONS. (a) During fiscal years
1	108	S.1453	Forestry and Communit	D	Forestry and Comm	2003	TITLE II—FOREST HEALTH SEC. 201. PURPOSE. The Se
1	108	S. 1938	Act to Save America's F	D	A bill to amend the	2003	(17)(A) clearcutting and other forms of even-age ma
1	108	H.R. 5312	Act to Save America's F	D	A bill to amend the	2003	(B) the reduction in habitat and food supply could di
4	109	H.R. 2744	Agriculture, Rural Deve	R	A bill making appro	2005	NO INFO ABOUT BARK BEETLE
1	109	S. 1897	Act to Save America's F	D	A bill to amend the	2005	(B) the reduction in habitat and food supply could di
1	109	H.R.4875	Rocky Mountain FIRES	D	Rocky Mountain Fo	2005	A bill To amend the Healthy Forests Restoration Act
1	109	S.2584	Rocky Mountain Forest	D	Rocky Mountain Fo	2005	A BILL To amend the Healthy Forests Restoration Act
1	109	S. 2604	Headwaters Protection	R	A bill to address the	2005	A BILL To address the forest and watershed emergen
1	109	H.R. 5305	Headwaters Protection	R	A bill to address the	2005	A BILL To address the forest and watershed emergen
1	109	H.R. 6237	Act to Save America's F	D	A bill to amend the	2005	(17)(A) clearcutting and other forms of even- age ma
1	110	H.R.5241	Colorado Forest Insect I	D	Colorado Forest Ins	2007	A BILL To amend the Healthy Forests Restoration Act
1	110	H.R. 7090	Act to Save America's F	D	A bill to amend the	2007	(19) The reduction in habitat and food supply could
1	111	S. 1713	Water Efficiency via Car	D	A bill to establish lo	2009	SEC. 2. FINDINGS AND PURPOSE.(a) FINDINGS.—Con
1	111	H.R. 3748	Water Efficiency via Car	D	To establish loan gu	2009	SEC. 2. FINDINGS AND PURPOSE. (a) FINDINGS.—Cor
1	111	S.2798	National Forest Insect a	D	National Forest Inse	2009	SEC. 2. PURPOSES. The purposes of this Act are— (1)
1	111	H.R.4398	National Forest Insect a	D	National Forest Inse	2009	SEC. 2. PURPOSES.(a) PURPOSES.—The purposes of t
1	111	H.R. 5192	Forest Ecosystem Recov	R	A bill to require the	2009	A BILL To require the Secretary of Agriculture to desi
2	112	H.R. 2578	Conservation and Econo	R	A bill to amend the	2011	(A) permit Native Corporations, including Sealaska, a
1	112	H.R. 1408	Southeast Alaska Native	R	A bill to provide for	2011	(A) permit Native Corporations, including Sealaska, a
1	112	H.R. 4331	National Forest Emerge	R	A bill to respond to	2011	A BILL To respond to the extreme fire hazard and uns
1	112	S. 2277	National Forest Emerge	R	A bill to respond to	2012	A BILL To respond to the extreme fire hazard and uns
1	112	H.R. 5960	Depleting Risk from Ins	D	A bill to amend the	2012	TITLE I—AMENDMENTS TO HEALTHY FORESTS RESTO
1	112	H.R. 6089	Healthy Forest Manager	R	A bill to address the	2012	A BILL To address the bark beetle epidemic, drought,
2	113	H.R. 1526	Restoring Healthy Fores	R	A bill to restore emp	2013	(4) HIGH-RISK AREA.—The term "high-risk area" mea
2	113	H.R. 4	Jobs for America Act	R	A bill to make revis	2013	(4) HIGH-RISK AREA.--The term \'high-risk area\' mea
1	113	S. 10	Agriculture Reform, Foc	D	A bill to reauthorize	2013	SEC. 8203. INSECT INFESTATIONS AND RELATED DISEA
1	113	H.R. 818	Healthy Forest Manager	R	A bill to address the	2013	A BILL To address the bark beetle epidemic, drought,
1	113	H.R. 1442	Depleting Risk from Ins	D	A bill to amend the	2013	TITLE I—AMENDMENTS TO HEALTHY FORESTS RESTO
1	113	H.R. 1895	National Forest Emerge	R	A bill to respond to	2013	A BILL To respond to the extreme fire hazard and uns
1	113	H.R. 740	Southeast Alaska Native	R	A bill to provide for	2013	. . .", the Tribal Forest Protection Act does not define

Congres	Bill Numbe	Link	Name of	Partty a	Summary	Year intod	Beetle Con	Level 1	Level 2	Level 1	Level 2	Level 1	Narr1	Narr2	Narr3	Nar 4	Geog1	Geog2
99	H. J. Res. 738		Appropria	D	Joint resolutic	1986	In page #3	10	11	99	99	99	0	0	0	0	0	99
100	H.R. 4784		Appropria	D	A bill making a	1988	In page #1	10	11	99	99	99	0	0	0	0	0	99
108	H. J. Res. 2		Continuin	R	A joint resolut	2003	H. J. Res. 2	10	14	99	99	99	4	0	0	0	1	3
108	H.R 1904		Healthy F	R	An Act. To im	2003	TITLE IV—I	10	998	20	21	20	4	6	0	0	0	99
94	S. 1146		Intensifie	D	To provide fo	1975	A BILL To p	30	33	99	99	99	0	0	0	0	1	2
99	H.R. 3037		Appropria	D	A bill making a	1985	Pine bark b	10	11	99	99	99	0	0	0	0	0	99
105	H.R. 4345		To autho	D	A bill to authc	1998	SEC. 2. WA	30	31	30	32	99	7	0	0	0	1	3
105	H.R. 4570		Omnibus	R	A bill to provi	1997	SEC. 1009.	30	31	30	32	99	7	0	0	0	1	3
107	H.R. 4766		Black Hill	R	A bill to decla	2001	SEC. 2. USE	30	99	99	99	99	1	0	0	0	1	3
107	H.R. 5319		Healthy F	R	A bill to imprc	2001	TITLE III—I	20	23	30	31	30	7	4	1	0	1	3
108	S.1314		Collabora	D	Collaborative	2003	SEC. 4. INS	10	11	99	99	99	0	0	0	0	0	99
108	S.1453		Forestry a	D	Forestry and	2003	TITLE II—F	10	11	99	99	99	0	0	0	0	0	99
109	H.R.4875		Rocky Mc	D	Rocky Mount	2005	A bill To am	10	15	20	24	30	1	4	6	0	1	2
109	S.2584		Rocky Mc	D	Rocky Mount	2005	A BILL To a	10	15	20	24	30	1	4	6	0	1	2
109	S. 2604		Headwat	R	A bill to addre	2005	A BILL To a	10	11	20	23	20	1	4	5	0	1	1
109	H.R. 5305		Headwat	R	A bill to addre	2005	A BILL To a	10	11	20	23	20	1	4	5	0	1	1
110	H.R.5241		Colorado	D	Colorado For	2007	A BILL To a	30	31	30	32	99	1	4	0	0	1	1
111	S. 1713		Water Ef	D	A bill to estab	2009	SEC. 2. FIN	10	15	99	99	99	4	0	0	0	0	99
111	H.R. 3748		Water Ef	D	To establish l	2009	SEC. 2. FIN	10	15	99	99	99	4	0	0	0	0	99
111	S.2798		National	D	National Fore	2009	SEC. 2. PUI	20	21	99	999	99	2	4	0	0	1	2
111	H.R.4398		National	D	National Fore	2009	SEC. 2. PUI	20	24	30	40	41	1	0	0	0	1	2
111	H.R. 5192		Forest Ec	R	A bill to requi	2009	A BILL To r	10	15	20	21	30	1	4	0	0	1	2
112	H.R. 4331		National	R	A bill to respo	2011	A BILL To r	20	21	30	31	30	1	4	0	0	0	99
112	S. 2277		National	R	A bill to respo	2012	A BILL To r	20	21	30	31	30	1	4	0	0	0	99
112	H.R. 5960		Depleting	D	A bill to amen	2012	TITLE I—AI	20	21	40	41	40	2	4	0	0	0	99
112	H.R. 6089		Healthy F	R	A bill to addre	2012	A BILL To a	20	23	30	31	30	1	2	3	4	0	99
113	S. 10		Agricultur	D	A bill to reaut	2013	SEC. 8203.	10	13	20	21	30	2	4	0	0	0	99
113	H.R. 818		Healthy F	R	A bill to addre	2013	A BILL To a	20	23	30	31	30	1	2	3	4	0	99
113	H.R. 1442		Depleting	D	A bill to amen	2013	TITLE I—AI	20	21	40	41	40	2	4	0	0	0	99
113	H.R. 1895		National	R	A bill to respo	2013	A BILL To r	20	21	30	31	30	1	4	0	0	0	99
113	H.R. 1526		Restoring	R	A bill to resto	2013	(4) HIGH-R	30	31	30	32	99	2	4	0	0	0	99
113	H.R. 4		Jobs for A	R	A bill to make	2013	(4) HIGH-R	30	31	30	32	99	2	4	0	0	0	99

Chapter Three: Final Thoughts



"Stop thinking, and end your problems"
~Lao Tzu

1. Final thoughts

I understood that policy is very important to come up with a proper forest management that faces a crisis such as the outbreak of bark beetle, and that developing effective forestry strategies and policies involves integrating the biological, social and economic factors which influence the decisions leading towards the implementation of one or more specified objectives. Forests are living systems that evolve over time with or without human intervention and it is to us to try to understand this changes to predict the direction and consequences of future changes.

Mexico is not safe from the MPB, as beetles do not recognize borders or countries like us humans. It is not only the U.S. West facing this problem, the bark MPB affect Canada all the way south across the U.S. to Mexico. Pine forests of México sustain constant pressure by these beetles, recent drought-related and warming has also been implicated as contributing to pulses or episodes of regional forest dieback such as those caused by bark beetle outbreaks in southwestern North America (Raffa et al., 2008) and northern Mexico (SEMARNAT, 2006).

Mexico already recognized this issue and has the Mexican Official Standard NOM-019-RECNAT 1999, which establishes the technical guidelines for the combat and control of bark beetles (SEMARNAT, 2006). The former standard mentions that in Mexico there are 11 species of bark beetles of the genus *Dendroctonus*, several of them are economically significant to the extent that today they are recognized as the most harmful forest pests in the country. The regions of highest bark beetle pressure in Mexico are restricted to small zones within specific mountain systems (the Transverse Volcanic Belt, followed by the Sierra Madre Occidental and the Sierra Madre Sur), which have sustained the greatest impact from this insect group during the last hundred years (SEMARNAT, 2006). The forest communities in these regions are among the most important in species diversity and genetic resources of *Pinus* in México. (Moreno, 2010)

What we could learn from this situation is that since the bark beetle outbreaks have been more recurring in the US and Canada, their management is more experienced and tested. For example; forest health assessments aided by bark beetle risk models or rating systems have already been conducted, prediction models developed in the U.S. and Canada are based on abundant information about site conditions and vegetation characteristics at different scales, as well as on bark beetle biology and ecology (Beukema et al., 1997). Mexico can learn from or adapt at least their theoretical techniques and apply it to possible future beetle outbreaks in the country. Although since the outbreaks cross borders of both countries and states, agreeing on control methods as well as objectives can result challenging for U.S., Canada and Mexico all together.

2. Personal

I first arrived to University of Oregon as a result of a scholarship that I became aware of through my University, UNAM Morelia. I spent two terms abroad and after coming back to Mexico for a couple of months I returned to Eugene, Oregon. After speaking with different people, I met Jesse Abrams who became my advisor once I decided to join a project. We started researching about the relationship between the Bark Beetle outbreaks and the policy responses in The Ecosystem Workforce Program. I was able to participate in this department given that they "*provide graduate and undergraduate students at the University of Oregon with experiential education through work study employment, paid and unpaid internships, independent study, and thesis advising*". As the program mentions in their webpage, they also state that these opportunities advance students' understanding and with technical skills through participation in real projects.

I found this experience very enriching because I had the opportunity to work closely with experienced researchers, which allowed me to see their work firsthand, learn from their way of thinking, analyzing and solving problems. Overall it gave me a perspective of the activities of a researcher in the daily routine and the importance of collaborating with others and working effectively as part of a team.

I learned the essentials of writing a research paper such as the importance of having a general outline to start writing and organizing ideas. I reinforced how to think, write and present information. Despite finding research very interesting and necessary, I reinforced my conviction that being a researcher is not for me. But, being a researcher it is not the only path in this vast field. Come to think about it, there are many paths related to this particular issue. For example, pest control, design and project management. As well as continuing education by doing masters in environmental law or management.

The participation in this research project helped me discover personal interests, helped me mature and gave me knowledge to face professional life, but most of all it was great for me meeting new challenges and demonstrating to myself the ability to complete a project.

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