# What Good Are Bugs?
# Importance of Invertebrates to Northwest Forests

The Xerces Society

# The Xerces Society for Invertebrate Conservation

Since 1971 we have been dedicated to protecting biodiversity through the conservation of invertebrates.

Major Programs:

- Conservation of invertebrates on public lands
- Pollinator conservation
- Endangered species protection and management
- Aquatic invertebrate assessment

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# Talk Outline

- Importance of Invertebrates
- Invertebrates and Forest Management
- Implications of Global Warming
- Conservation for Invertebrates

http://www.nwnature.net/

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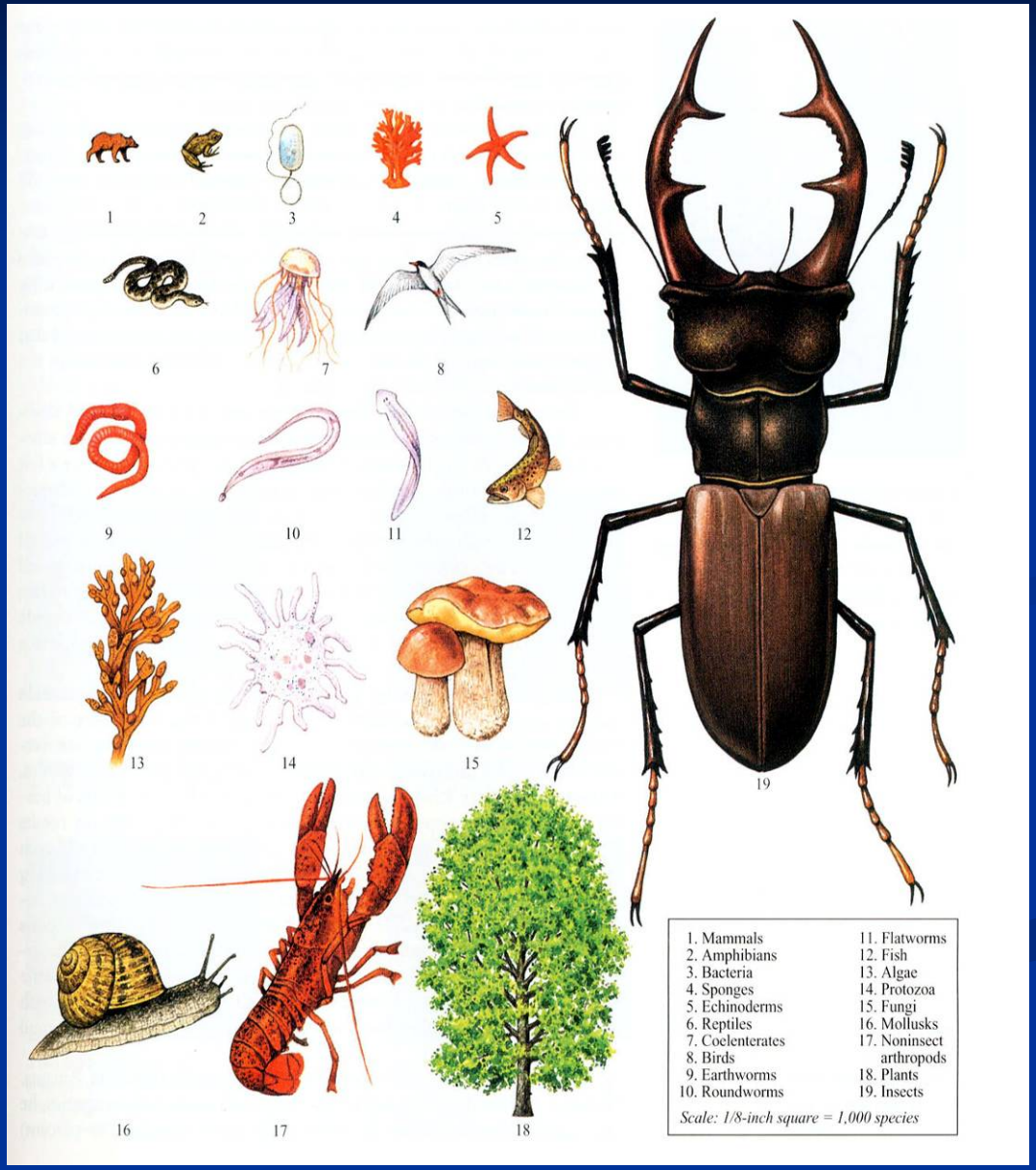
# Importance of Invertebrates: Diversity

Rank of Diversity

1. Insects
2. Plants
3. Non-insect arthropods
4. Mollusks
5. Fungi
6. Protozoa
7. Algae
8. Fish
9. Flatworms
10. Roundworms
11. Earthworms
12. Birds
13. Coelenterates
14. Reptiles
15. Echinoderms
16. Sponges
17. Bacteria
18. Amphibians
19. Mammals



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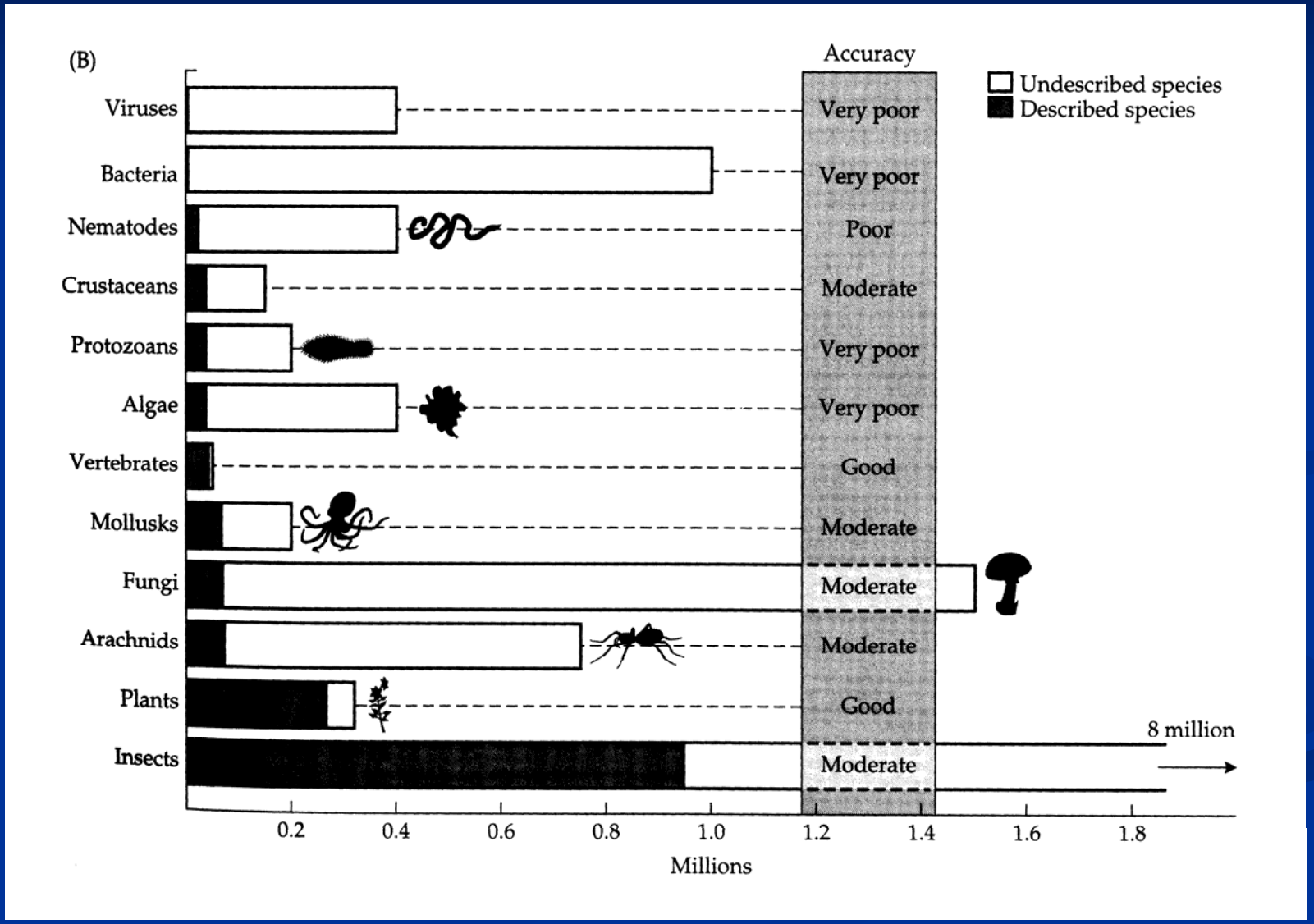
# Importance of Invertebrates: Diversity




(IUCN 2001)

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# Importance of Invertebrates: Diversity in Northwest Forests

3,400 different insect species are known from a single 6,400 ha site in Oregon (Lattin, J.D. 1993) .

Photo by Dr. Bruce G. Marcot

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# Importance of Invertebrates: Indicator species

Photo by Tom Kogut, USFS



Photo by Kristina Ovaska

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# Importance of Invertebrates: Decomposition

Insects, worms, millipedes and mites are extremely important in helping microbes break down dung, and dead plant and animal matter.

www.nwnature.net/fauna/other/images/millipede.

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# Importance of Invertebrates: Herbivory

Photo by Dave Powell

Turnover of plant parts through herbivory, mortality, and decomposition maintains nutrient-cycling processes that are essential to soil fertility (Haack and Byler 1993).

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# Importance of Invertebrates: Food

Invertebrates are a part of nearly every food chain directly as food for other insects, fishes, amphibians, reptiles, birds, mammals, and other arthropods

Photo by Aaron Barna

Photo by James Solomon

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# Importance of Invertebrates: Food

Midges are the most important food source for juvenile salmon

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# Importance of Invertebrates: Keystone Species

Insect pollinators are required for
> 67% of flowering plants
(~ 240,000 sp.) (Klein 2007).

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# Importance of Invertebrates: Keystone Species

The mountain pine beetle has been an integral part of pine ecosystems almost as long as the ecosystems have existed, with beetle epidemics playing an integral role in the structure and dynamics of these communities. (Fuchs 1999).

Photo by Dave Powell

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# Importance of Invertebrates: Summary

Native forest insects (including pests) have been part of our forests for millennia and function as nutrient recyclers; agents of disturbance; members of food chains; and regulators of productivity, diversity, and density (Black 2005).

Photograph © Edward Ross

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# Invertebrates and Forest Management: Rare and Endangered Species

Most of the jumping slugs (like the Malone jumping slug *Hemphillia malonei*) are found in coarse woody debris or moss mats on decaying logs –features that are often found in older forests. (Leonard and Ovaska 2003)

Photo by Kristina Ovaska

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# Invertebrates and Forest Management: Rare and Endangered Species

Photo by Tom Kogut, USFS

The Mardon skipper butterfly (*Polites mardon*) is dependent upon native meadows primarily on Forest Service and BLM lands in Oregon and Washington. This meadow habitat has declined due to, fire suppression, livestock grazing, and introduction of invasive plants (Black and Vaughan 2001).

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# Invertebrates and Forest Management: Rare and Endangered Species

The Western Pearlshell mussel lives in cold, clean streams and rivers. It lives over 100 years. Its host species include native trout and salmon. The Western Pearlshell is one of the most sensitive mussel species in the Pacific Northwest.

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# Invertebrates and Forest Management: Pesticides

Insecticide applications can threaten insects populations. Btk (*Bacillus thuringiensis* var. *kurstaki*), a Lepidoptera-specific insecticide, has been used widely to treat defoliators in western forests (Wagner and Miller, 1995).

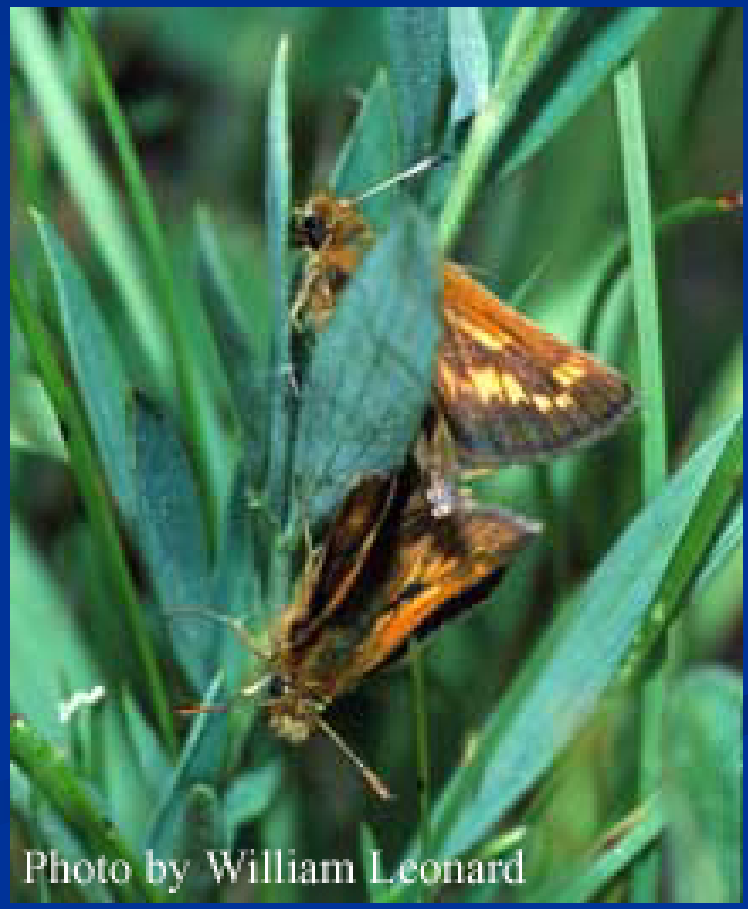
Photo by William Leonard

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# Invertebrates and Forest Management: Roads

Roads can serve as corridors for dispersal for non-native invasive invertebrate species.

Silt from logging roads also negatively impacts aquatic macroinvertebrates which are an important food source for fish.

Salmon River Restoration Council

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# Invertebrates and Forest Management: Grazing

There is little doubt that grazing by cattle, sheep, goats, horses, and other livestock can greatly alter the structure, diversity, and growth habits of a plant community, which in turn can affect the associated insect community (Kruess & Tscharntke 2002).

Photos of cattle on National Forest lands by Sarina Jepsen

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# Invertebrates and Forest Management: Fire Suppression and Logging

*Photograph of clearcut in the Willamette National Forest, Oregon. © Steve Holmer.*

Logging and fire suppression have led a loss of invertebrate diversity. These simplified forests may be at an increased risk of insect outbreaks (Anderson et al. 1987, Ferrell 1996, Filip et al. 1996, Hessburg et al. 1994, Maloney and Rizzo 2002, McCullough et al. 1998, Mitchell 1990, Schowalter and Withgott 2001, Stephen et al. 1996, Swetnam and Lynch 1993).

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# Invertebrates and Forest Management: Prescribed Fire

Prescribed fire can promote more natural forest conditions. Fire should be used carefully especially in and around small isolated meadows as they may harbor important pollinator species (Hodges and Black 2007).

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# Invertebrates and Forest Management: Forest Pests

**Rethinking insects. What would an ecosystem approach look like?**

At the community level, outbreaks of plant-eating insects can help keep a system healthy. (Schowalter and Withgott 2001)

Photograph © Edward Ross

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# Invertebrates and Forest Management: Forest Pests

Some scientists have suggested caution in using thinning to control bark beetles, because geographic and climactic variables may alter the effect (Hindmarch and Reid 2001).

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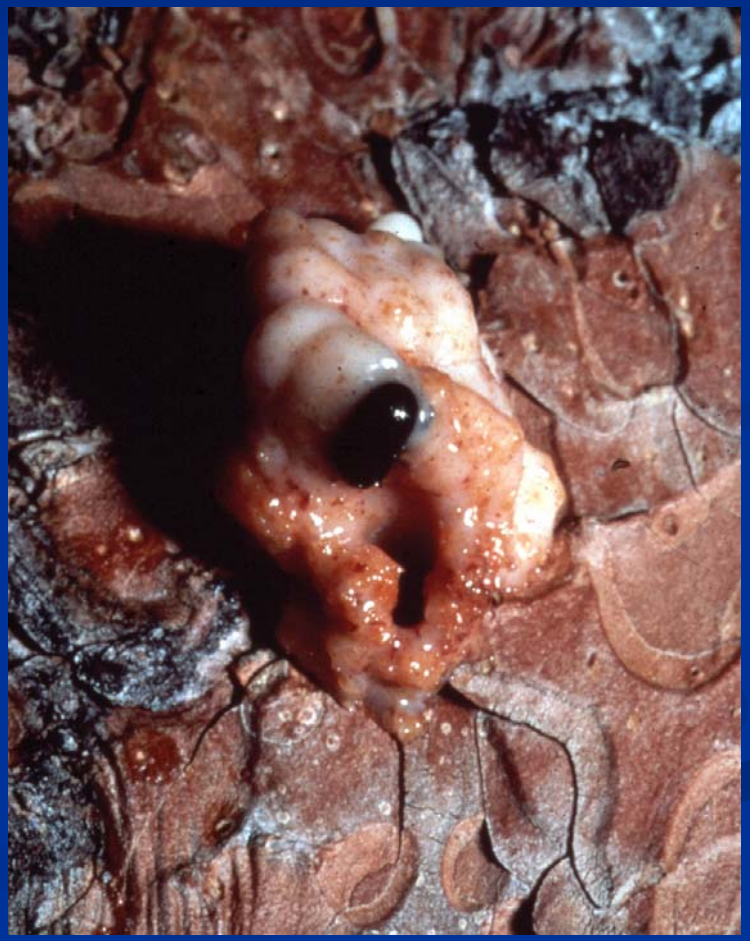
# Implications of Global Warming

Logan and Powell (2001) predict that the mountain pine beetle may expand its range to both higher elevations and higher latitudes as the climate warms.



Photograph © Dave Leatherman.

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# Implications of Global Warming

There is evidence that warming temperatures are already leading to shifts in butterfly ranges (both north and to higher elevations) and leading to declining habitat for species that use ephemeral water sources (Black in press).

Photo by Scott Black

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# Conservation of Invertebrates

- Decommissioning roads
- Limiting pesticides
- Managing for rare and endangered species
- Rotational grazing with long recovery periods and exclusion from sensitive areas
- Managing for healthy riparian areas

Photo by Ron Lyons

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# Conservation of Invertebrates

Maintain and restore high-quality late-successional and old-growth forest conditions. Diverse, old forests contain an array of rare invertebrates as well as natural predators and pathogens.

Old-growth forests are also highly productive and remarkably resistant to potential pests (Showalter 1990).

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# Conservation of Invertebrates

Ensure structural and species diversity when logging, including the retention of large trees and snags, downed wood, and canopy closure. These practices are essential for the retention of many rare species and can help minimize large outbreaks of insect pests.

extension.usu.edu/.../Assets/Images/Snag.jpg

"If the land mechanism as a whole is good, then every part is good, whether we understand it or not. If the biota, in the course of eons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering."

*Round River: from the journals of Aldo Leopold*, 1972

Artist: Viv Eisner