

Earthworms in Alaska: friend or foe?

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Outline

Alaska's earthworms

How they get around

All worms are not created equal

Earthworms in agriculture

Earthworms as invasive species

Earthworm management

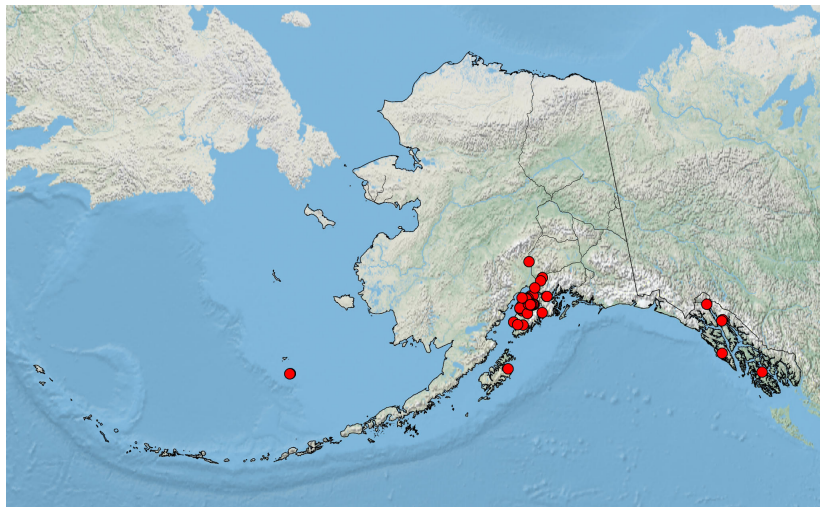
Credits



Pleistocene earthworm extirpation



Earthworm distribution in Alaska



Data from literature and specimen records as of 25.Feb.2015.

Earthworm diversity in Alaska

exotic and feral

Allolobophora chlorotica
Allolobophoridella eiseni
Aporrectodea rosea
Aporrectodea trapezoides
Aporrectodea tuberculata
Aporrectodea turgida
Dendrobaena octaedra
Dendrodrilus rubidus
Eiseniella tetraedra
Lumbricus castaneus
Lumbricus rubellus
Lumbricus terrestris
Octolasion cyaneum
Octolasion tyrtaeum

exotic and synanthropic

Eisenia foetida

native?

Arctiostrotus sp.
Sparganophilus sp.

$\Sigma = 17$ species

Earthworm dispersal

- ▶ Slow natural dispersal (15-30 ft./yr)
- ▶ Almost all long-range dispersal is human-caused:
 - ▶ Eggs and cocoons can be spread in tire treads
 - ▶ Transport of soil (e.g., potted plants)
 - ▶ Transport of wood and other material stored on the ground
 - ▶ Bait abandonment
- ▶ Some evidence that they may be washed down streams



Nightcrawler



Lumbricus terrestris



- ▶ Deep burrowers, bringing leaf litter into mineral soil and depositing mineral soil on the surface.
- ▶ Apparently limited distribution in Alaska at present
- ▶ Commonly sold as live bait
- ▶ Large worms

Red Wiggler



Eisenia fetida

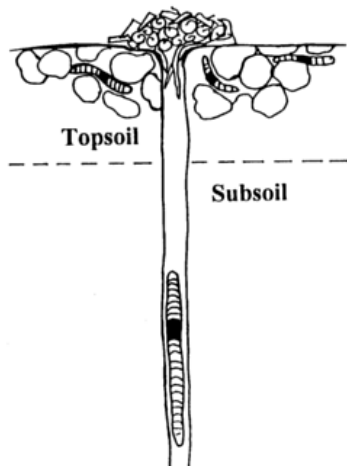


- ▶ Specialists in decomposing matter, rarely found in soil
- ▶ Popular worm for vermicomposting
- ▶ Apparently unable to survive out-of-doors in Southcentral Alaska

Earthworms in agriculture

That earthworms increase plant productivity in agricultural systems is generally accepted.

- ▶ ↑ shoot biomass in 79% of studies
- ▶ ↑ tilth, improve soil structure
- ▶ ↑ aeration
- ▶ ↑ water infiltration
- ▶ ↑ nutrient cycling



Earthworms in agriculture

- ▶ Earthworms make a relatively larger contribution in low-till/no-till systems and in organic farming.
 - ▶ Earthworm populations are usually higher in no-till systems than in conventional plow systems



Ramifications of earthworm infestations



before



after

Ramifications of earthworm infestations



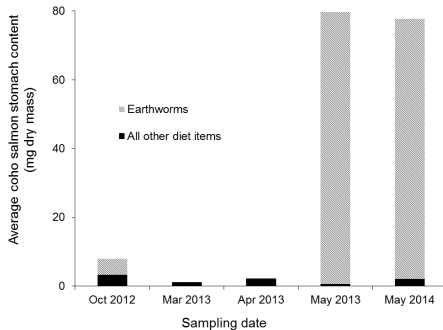
before



after

Ramifications of earthworm infestations

Earthworms as salmon food (Rinella et al., 2014)

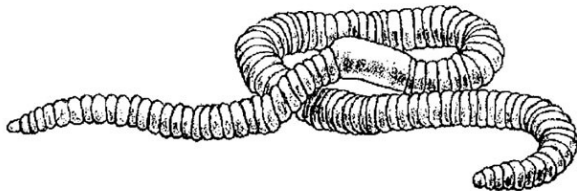


Earthworm management for agriculture



No-till
Crop rotations
Manure
Organic amendments
Surface crop residue
Fertilizer
Lime

PRACTICES FAVORING EARTHWORMS



PRACTICES HURTING EARTHWORMS

Tillage
Acidification
Removal of crop residue
Toxic products

Limiting earthworms as exotic species

- ▶ Infested soil, compost, worm castings, and plantings should not be transported to worm-free areas.
- ▶ Additional earthworm species should not be imported into Alaska.
- ▶ Vermicompost operations should use species not likely to persist in Alaska.
- ▶ Fishing regulations should explicitly and clearly disallow the use of live earthworms as bait.



- ▶ Tires of forestry equipment, trucks, and ATV's accessing remote areas should be cleaned to prevent the spread of eggs and cocoons trapped in soil between tire treads.

Acknowledgements

- ▶ John Morton, USFWS Kenai NWR—for his support
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- ▶ John Reynolds—earthworm identifications

Image sources

- ▶ Pleistocene glaciation map by John S. Schlee, U.S. Geological Survey, http://www.americanroads.us/oceanlinks/pleistocene_NA_map.jpg
- ▶ *Dendrobaena octaedra* and *Lumbricus terrestris* paintings courtesy Nature Canada, apparently no longer available on-line
- ▶ *Eisenia fetida* image by Mihai Duguleana, <http://commons.wikimedia.org/wiki/File:Redwiggler1.jpg>
- ▶ *Eisenia fetida* on compost bin by Toby Hudson, http://commons.wikimedia.org/wiki/File:Eisenia_fetida_on_compost_bin.jpg
- ▶ Photo of tub of earthworms from ScienceNews for Kids <http://www.sciencenewsforkids.org>

Image sources (continued)

- ▶ Orchid *Listera cordata*,
http://commons.wikimedia.org/wiki/File:Listera_cordata_5-eheep_%285097458599%29.jpg
- ▶ Common shrew by Michael Patrikeev,
http://wildnatureimages.org/sitebuildercontent/sitebuilderpictures/masked_shrew_9804.jpg
- ▶ Earthworm midden, [https://www.extension.purdue.edu/extmedia/ay/images/AY-279.fig1.gif](https://www.extension.purdue.edu/extmedia/ay/images AY-279.fig1.gif)
- ▶ Practices affecting worms graphic: Penn State Extension,
http://extension.psu.edu/plants/crops/soil-management/images/management-practices-favoring-and-hurting-earthworms/image_full-width-no-col

Image sources (continued)

- ▶ Before and after photos courtesy Great Lakes Worm Watch, <http://www.nrri.umn.edu/worms/default.htm>
- ▶ White sweet clover image from [invasive.org](http://www.invasive.org/browse/detail.cfm?imgnum=1196266), <http://www.invasive.org/browse/detail.cfm?imgnum=1196266>
- ▶ Garlic mustard image from http://upload.wikimedia.org/wikipedia/commons/4/48/Allaria_petiolata%2804%29.jpg
- ▶ Rinella et al. (2009) images from http://www.uaf.edu/files/ces/pests/cnipm/annual_invasive_species_c/15th_annual_meeting_anch/Rinella-Daniel.pdf
- ▶ Tilling tractor photo by Loren Holmes, Alaska Dispatch News, <http://www.adn.com/article/anchorage-farmers-markets-get-full-swing>