Where do all the soil critters go in the winter?

We are currently in the season of fall; despite these warm temperatures we have been experiencing! As my title reads, 'Where do all the soil critters go in the winter'? We know that many birds migrate south for the winter and other mammals hibernate, enter torpor (light hibernation), or adapt to the changes of seasons, but what do all of the soil critters do? Are they similar to mammals, or do they have other processes which they go through to survive winter?

First off, soil provides an insulating effect, which in turn is insulated by the aboveground layer of snow.

There are 3 strategies that critters use to prepare for and transition to winter (survival) mode.

1) *Venturing to the Deep* – many of the larger critters, like earthworms and other insects burrow down into the soil as temperatures decrease in search of a depth of soil below the frost line, where temperature and moisture are adequate.
2) *Dormancy* – Many organisms enter a period of dormancy, which is a state of lowered metabolic activity. For example, earthworms, they congregate and coil into a slime-coated ball to enter a state called estivation, which protects them from freezing and drying out; this is similar to hibernation. Insects and other invertebrates may enter diapause, a hormonally controlled state where metabolism is reduced and development halted, all in response to environmental cues (temperature, day length, food scarcity).
3) *Chemical Alterations* – Many insects and some microbes start producing cryoprotectants, like glycerol and sugars, which act like anti-freeze (yes, you are thinking about frogs right now and they use cryoprotectants to survive winter as well!). These lower the freezing point of body fluids, allowing regular bodily processes to continue but at a lower level.

Now let's talk about some specific soil critters! Many soil critters function quite similarly to their mammal friends as described at the beginning of this article.

Let's start with *Ants*, they, like black bears, skunks, and squirrels, enter torpor or a light hibernation where they are in a dormant state, activity and metabolism slow down, and they (ants) venture deep into their nests and consume food reserves when hungry.

One that everyone loves, *spiders*! These fellas are my favourite! Spiders stay active during winter, living on the ground and underneath the protection and insulation of the snow (subnivean), as well as in leaf litter, in wood, our humble abodes, etc. They enter diapause and have reduced activity and therefore require less food. Many also produce cryoprotectants dependent on their species type and location.

If your home is like mine, you share it with *ladybugs* and a "few" flies because a house is a protected, warm, and dry environment, in which these friends seek out for winter. Aside from human habitats, lady bugs congregate in natural areas like underneath bark, in rotting logs, or within leaf litter, for warmth and protection. They will then enter diapause.

One quick clarification. The difference between Torpor and diapause: Torpor, animals voluntarily lower their: heart rate, body temperature, and metabolism for the purpose of *energy conservation;* they are being strategic with how and when to expend their energy. Diapause, insects etc. reduce their

metabolism with the purpose of suspending development and growth, they essentially go into maintenance mode all winter. Insects also perform other changes and adaptations that also reduce their body temperature, heart rate, etc. and those will contribute to their state of diapause, not cause it.

Example to solidify your understanding, black bears enter Torpor during winter and females at the time are pregnant, through the winter months the cubs are growing and developing until January when they are birthed. Mama bear's body is using food and energy to maintain her bodily processes in which to supply her cubs with nutrition and the proper environment to grow. Woolly Bear caterpillars, which you likely see crawling around in the fall, they produce cryoprotectants and enter diapause for winter. In the spring the caterpillar wakes up and emerges from diapause to look for a location to complete its development, pupate into a cocoon, and eventually develop into an Isabella Tiger Moth. Clear as mud?