Army Cutworm Outbreak Produced Cheatgrass Die-offs and Defoliated Shrubs in Southwest Idaho in 2014

By Cindy Salo

On the Ground

- Army cutworms consumed cheatgrass to produce cheatgrass die-offs at low elevations in southwest Idaho in 2014. The larvae also consumed foliage and bark of chenopod shrubs.
- Army cutworm outbreaks seem to occur after many adult moths lay eggs in areas experiencing drought, which received late summer rain to germinate winter annuals, but little subsequent precipitation through the following winter.
- Army cutworms hide in plain sight by feeding at night in winter and hiding in soil or under objects during the day.
- A network of observers in the Intermountain West could help rangeland managers identify die-offs for reseeding with desirable species.

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Rangeland managers and researchers were mystified in 2003 when kilometer-wide holes appeared in the blanket of exotic cheatgrass (*Bromus tectorum*) covering large swathes of the Intermountain West. The 2003 cheatgrass "die-offs," or more correctly, stand failures, occurred in Idaho, Nevada, Utah, Colorado, and New Mexico[1] and have reappeared patchily and sporadically since. Although people disagree about what causes the die-offs, most recognize these events may be opportunities for reseeding with desirable species on rangelands invaded by cheatgrass.[2]

Cheatgrass die-offs are areas where cheatgrass is usually present but is absent for one or more growing seasons. Winter annual mustards (Brassicaceae) are also absent in die-off areas, and gray litter is usually present. Perennial grasses and forbs are unaffected and often robust, presumably taking advantage of abundant water and nutrients left by the dearth of winter annuals. Die-off areas can have abrupt boundaries when they occur within a matrix of normal-appearing cheatgrass stands; these boundaries can also be found where the vegetation matrix transitions from a cheatgrass-dominated stand to a different vegetation or soil type. Die-offs occur on sites dominated by shrubs, where the absence of cheatgrass can be subtle, and on sites usually dominated by cheatgrass, where the absence of this annual grass leaves the site bare. The 2003 die-offs were estimated to cover over 280,000 ha in northern Nevada alone.[3]

A few people saw cheatgrass seedlings disappear in early 2003, before the die-offs were apparent. While I explored die-off areas later that year, some of the witnesses shared what they learned with me. Bob Hammon (Colorado State University Extension, personal commmmunication) described a large army cutworm (*Euxoa auxiliaris*) outbreak in western Colorado in early 2003. The larvae consumed crops and rangeland plants, including cheatgrass. Hammon recounted conditions before and during the outbreak and suggested how they might have affected the insects:

1. A year of dry weather through summer 2002 increased bare ground for egg laying.
2. Numerous adult moths arrived in fall 2002 to lay eggs.
3. Heavy rain in late summer 2002 germinated winter annuals for larvae to eat.
4. Dry weather from winters in 2002 to 2003 limited larval diseases.

Weather data from Grand Junction, Colorado[4] (Fig. 1) support Hammon's description. In January 2014, I recognized similar conditions in southwest Idaho and predicted an army cutworm outbreak.

Army Cutworm Life History

Army cutworms are the nocturnal larvae of miller moths. These native North American larvae consume emerging small grains, alfalfa, and canola in winter and early spring in the southern Great Plains[5] and southern Canada.[6] Larvae feed above ground at night and usually hide in soil during daylight, but will emerge to feed on cloudy days.[7] Even when feeding above ground, young larvae are tiny, and can damage vegetation

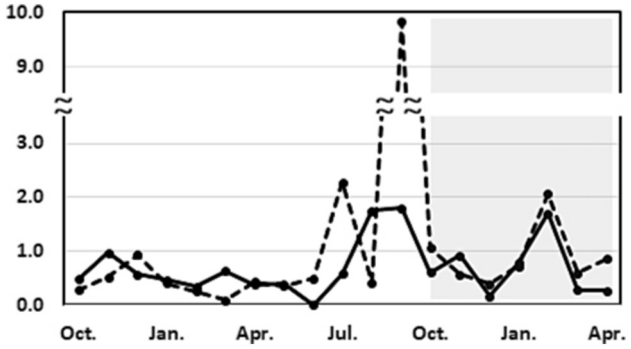

Figure 1. Portion of average monthly precipitation received each month before and during two army cutworm (*Euxoa auxiliaris*) outbreaks in the Intermountain West. Time period starts October, 1.5 years before each outbreak, and ends April of each outbreak. Gray shaded area is the period army cutworm larvae are present. Solid line indicates the 2003 outbreak near Grand Junction, Colorado[4]; dashed line, 2014 outbreak in southwest Idaho.[12]

before they are seen. Dry winter weather reduces diseases and parasites that kill larvae (B. Hammon, personal communication).

Larvae pupate in spring and emerge as miller moths. Moths emerging in the Great Plains fly to the Rocky Mountains.[7] The moths feed on nectar at night and rest in high elevation talus slopes during the day,[8] where grizzly bears (*Ursus arctos horribilis*) feast on them.[8] Surviving moths return to the Great Plains in fall to lay eggs.

We know little about army cutworms west of the Rockies. Although a 1982 review[9] noted that army cutworms are responsible for the "destruction of both range grasses and crops," many rangeland managers are unaware of these pests. An army cutworm outbreak that damaged crested wheatgrass seedings in southwest Idaho in the late 1960s[10] has been largely forgotten.

We know even less about the adult moths and their habits in the Intermountain West. After a 2003 army cutworm outbreak in northern New Mexico (C. Sutherland, New Mexico State University Extension, personal communication), black bears (*Ursus americanus*) were seen feeding on miller moths in a subalpine rock field in the area.[11] This suggests that adults emerging in the West may migrate only short distances to nearby mountain ranges.

Conditions and Study Sites

In October 2013, my miller moth pheromone traps in Boise, Idaho caught more than 100 times as many moths as in 2012 or 2014. September 2013 precipitation was almost 10 times the average at Grand View[12] (Fig. 1), in southwest Idaho. However, precipitation during the 2012 to 2013 water year (1 October–30 September) was only 0.8 of average. After the heavy rain in September and October 2013 through January 2014, precipitation was 0.7 of the average at Grand View.[12]

The large fall moth flight, heavy late summer rain, and subsequent dry weather were conditions for an army cutworm outbreak. I knew I could not find the patchily distributed larvae alone, so I emailed dozens of "Wanted" flyers in late January 2014, asking for help. Responses started in late February and provided the following four study sites: Murphy, Oreana, Grand View, and Sugar Valley, Idaho.

At Murphy, Karen Steenhof (US Geological Survey) saw "thousands" of army cutworms by February 22, plus one of the largest flocks of starlings (*Sturnus vulgaris*) the bird researcher had seen in the area. Steenhof recalled a flight of moths that dirtied windows in her neighborhood the previous fall. A storm in September 2013 caused a severe flash flood in nearby Briar Creek (personal communication).

At Oreana, Jean Barney saw a "huge" outbreak of larvae and "flocks of robins (*Turdus migratorius*) in feeding frenzies" by February 15. She recalled an "exceptional number of millers late last summer" and "massive greening and growth of cheatgrass last October after heavy rainfall and a flash flood" (personal communication).

At Grand View, Jon Haupt (US Bureau of Land Management, Bruneau, Idaho) spotted larvae in late February. He described an area "devoid of green cheatgrass…where cutworms, I believe, have caused mortality of cheatgrass" (personal communication).

In Sugar Valley, near Bruneau, Shane Jolley sprayed an alfalfa fields for army cutworms in early March 2014 after larvae spread from adjacent rangeland (personal communication). Neighboring ranchers Mary and Gene Tindall watched cheatgrass grow in Sugar Valley and then fade to bare soil in March and April (personal communication).

Rob McChesney (US Department of Agriculture, Plant Protection and Quarantine [USDA-PPQ], Boise, Idaho) collected larvae in Owyhee County in February 2014 (personal communication). Entomologists at the University of Idaho and USDA Center for Plant Health Science and Technology identified the larvae as *Euxoa auxiliaris* (personal communication).

This observational study recorded army cutworm damage and subsequent recovery of vegetation at these four sites, totaling 215 ha, from February 2014 to May 2016 (Table 1). Sites included Wyoming big sagebrush (*Artemisia tridentata* subsp. *wyomingensis*), low sage (*Artemisia arbuscula* ssp. *longiloba*), and salt desert scrub vegetation. The shrub species listed in soils descriptions[13] differed slightly from those found at the sites. These differences could be due to unmapped contrasting soils within soil map units, or previous sowing or transplanting activity.

I collected qualitative and photographic data, including video. At Sugar Valley, I photographed repeatedly two transects on the same soil type, one affected by army cutworms and one unaffected. The vegetation and soil surface to the north and south were photographed every 160 m along the two 640-m long transects.

Field Observations

Many army cutworms were feeding above ground on sunny days (Fig. 2A) at the three sites I visited in late February and early March (Murphy, Oreana, and Grand View). This suggests that the normally nocturnal insects were short of food. Although these sites typically support stands of cheatgrass and mustards, none of these plants were present. Larvae nibbled on a few