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# RANGE EXTENSION OF *LOGFIA ARVENSIS*: LONG-DISTANCE DISPERSAL WITH A LITTLE HELP FROM US?

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# ABSTRACT

The annual plant, *Logfia arvensis*, is broadly distributed in the northwestern USA. We report a southern range expansion of this species through the discovery of eighteen new locations in northern Colorado. Using localities of previously recorded *L. arvensis* collections, the new Colorado locations, and current and historic fire information, we explore the species distribution in relation to fire. Three hypotheses are considered for the new range expansion, with inadvertent introduction through timber harvest or sowing of seeds for site rehabilitation in the burned areas as other possibilities.

*Logfia arvensis* (L.) Holub (Asteraceae) was introduced to North America (Lesica et al. 2012; USDA) and is distributed within North America in Canada and the USA (OR, WA, ID, MO, WY, SD, NB, TX, WI, MI, NY) (USDA). It grows in various habitats, including fields, meadows, disturbed sites, and roadsides (Giblin et al. 2018). See Figures 1, 2, 3. This paper reports new records from Colorado, which suggests it is newly introduced to these areas. In 2019, a specimen was collected within a past burn area in Jackson County. In 2022, eight specimens were collected in a post-fire area in Larimer County, and in 2024, nine specimens were collected from an area previously seeded following a timber harvest in Larimer County.

## Vouchers. Colorado.

## Jackson Co.:

Between County Road 6E and County Road 6W in NE Jackson County, 40.922918N, -106.54399 W, 27 Aug 2019, *Birtwistle s.n.* (GREE) Site is diverse, with moderate burn severity.

#### Larimer Co.:

The following nine collections were collected as part of a class field trip on 11 Sep 2022. Sites CP-MC-105, *Reveles-Hernandez 6* and 22 (GREE 44874, 44876); CP-MC-107, *Swanson 18* (GREE 44872) and CP-MC-108, *Canton 8* (GREE 44877); south of Flowers Road (FR 152) at Jacks Road Spur, south of Bedsprings Spring at ca. 2561.5 m to 2569.8 m elev, (40.632418N, -105.552519W; 40.631587N, -105.549319W; 40.632322N, -105.549929W; respectively). These sites share similar topography characterized by open meadows, sparse vegetation, and occasional shrub and tree cover. South of Pingree Park Road, just north of Jacks Gulch Campground, at elev ca. 2483.2 m to 2490.8 m; CP-MC-101, *Erskine 15* (GREE 44873), CP-MC-102, *Hobbs 5* (GREE 44870) and CP-MC-112, *Maldoff 6* (GREE 4487114) (40.643174N, -105.525595W; 40.643305N, -105.52452W; 40.642378, -105.526275W; respectively). These sites also feature open areas with scattered shrubs and are adjacent to Jacks Gulch Campground, suggesting potential moisture sources and a mix of disturbed and natural vegetation. Sites CP-MC-109, *Erskine 23* (GREE 44878) and CP-MC-111, *Hobbs 13* (GREE 44875), (40.629888N, -105.544611W; 40.642378N, -105.541226W; respectively); just west of Jacks Gulch Campground, shares the similar characteristics of the other sites in terms of elevation and habitat type.

The following nine collections were collected as part of a class field trip on 14 and 15 Sep 2024. 2024. Sites ML-01-S, Walker 5; and ML-02-S, Billah 3; S of Flowers Road (FR 69B), ca. 0.5 to 0.7 mi E Granite Ridge TH at ca. 2605 m to 2592 m elev, (40.76588N, -105.59939W; 40.7666737N, -105.5943387W; respectively). These sites are open areas with burned tree stumps. N of Flowers Road (FR 69B), just S of Molly Lk, ca. 1 mi E of Granite Ridge TH at elev ca. 2598 m. Site ML-03-S, Jackson 318 (40.76664973N, -105.5897727W) is characterized by an open grass area on a slight slope. East of Flowers Road (FR 267A) just past spur from Flowers Road (FR 69B) at elev ca. 2600 m. Site ML-04-S, Posada Velez 18 (40.76608N, -105.586511W), features an open forest, sloped terrain, and adjacent roads containing burned trees. Site ML-05-S, Kettler 6 and 25; W of Flowers Road (FR 509), across from CG site #22, 0.3 mi from Manhattan Rd at elev ca. 2694 m (40.7498417N, -105.6032896W). This location has an open area, is road-adjacent, and is rocky, with campgrounds nearby. Site EL-06-S, Faehnrich 16; E of Bellaire Lk, 60 m ENE of Bellaire Lk Picnic Site at elev ca. 2633 m (40.7717626N, -105.6146256W). The EL-06-S site is characterized by an open area of disturbed land with fallen, burnt timber on sloped terrain. W of Manhattan Rd, just opposite Flowers Road (FR 266), ca. 1 mi S of West CR74e at elev ca. 2599 m. Site EL-08-S, Pecar 21 (40.7771374N, -105.6053656W) has burned areas with sandy soil and no plants. Site ML-09-S, Salinas 40, N of Flowers Road (FR 69B), ca. 250 m E of Granite Ridge TH at elev ca. 1554 m (40.37731N, -105.45504W), features a sloped area with open grass. All the 2024 specimens have not yet been accessioned into the GREE collection.



Figure 1. Logfia arvensis in its open forested habitat, from Site ML-04-S on 14 Sep 2024.



Figure 2. *Logfia arvensis* collection from Plot CP-MC-107, Swanson (GREE 44872), collected 11 Sep 2022.



Figure 3. *Logfia arvensis* collection from Plot CP-MC-101, Erskine (GREE 44873) collected 11 Sep 2022.

#### **Methods and Results**

One of the Logfia specimens (Birtwistle s.n.) was collected in association with an Assessment, Inventory, and Monitoring (AIM) plot (Kachergis et al. 2022) that occurred within the 'Beaver Creek' fire. The nine 2022 specimens were collected as part of a class project at the University of Northern Colorado. Students aimed to inventory the understory vegetation post-burn in the 'Cameron Peak' fire area. The project from which the 2022 collections were recorded included visitation of ten plots, four of which were noted as having experienced low-moderate burn severity, and the other six experienced high-severity burns. Logfia arvensis was recorded in eight of those ten plots; for the two plots in which it was not recorded were one low-moderate severity and one was high-severity area. The nine 2024 specimens were also collected as part of a different class project at the University of Northern Colorado. The sampling areas for the 2024 effort were just adjacent (and outside) the 'Cameron Peak' fire area. Timber harvests in these areas occurred between 2015-2017 and landing sites where heavy equipment was staged were de-compacted and seeded by the US Forest Service to encourage revegetation. The project in 2024 sampled nine plots in seeded areas over these previous landing areas, and eight plots were located within 800m but located outside the cutting unit and were unseeded. Students aimed to inventory the understory vegetation by comparing seeded versus unseeded forest control sites. L. arvensis was incidentally found in eight of the nine seeded plots and none of the unseeded plots. All reported locations occurred within mixed conifer forests (Pinus contorta, P. ponderosa, Pseudotsuga menziesii).

The new locations reported here are all based on vouchered specimens. US Forest Service botanists have reported unvouchered observations of *Logfia arvensis*, prompted by the current work, in nearby post-burn sites (e.g. 2012 High Park Fire in Laramie County observed in 2014 and 2020 East Troublesome Fire in Grand and Larimer Counties; pers. comm. Carlee Coleman).



Figure 4. Map of the United States showing the locations of *Logfia arvensis*. The red dots are *L. arvensis* collections occurring in sites that had experienced a fire. The blue dots are *L. arvensis* collections from areas where there was no record of a fire prior to its collection.

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## **Existing collection data**

We extracted all the data for 457 collections this taxon (as Logfia-355 and Filago-102) available through the SEINet Portal Network (May 2024). We removed 171 of these collections because they were located outside of the USA, had no location data, or were duplicates. Eighteen of the remaining specimens included collection information but not exact geographic coordinates; we were able to georeference all these locations for inclusion in our analysis.

Coordinates for the 286 previously recorded *Logfia arvensis* locations and the 19 locations in Colorado were uploaded into ArcGIS Pro. We obtained current and historic fire perimeters for the USA from the Monitoring Trends in Burn Severity (MTBS 2022). Using the Intersect tool in ArcGIS Pro, we calculated which L. arvensis collection points were collected inside a fire perimeter polygon (i.e., the site experienced a burn prior to collection of the L. arvensis collection). The specimen locations that were collected inside a fire perimeter were downloaded onto a table, and we compared fire dates with specimen collection dates. All L. arvensis locations collected after the fire were noted (Figure 4), which suggests these localities represent potential "fire-following" events. Of the 305 recorded L. arvensis locations, 35 specimens were collected after a fire (mininum: 1 year after the burn, maximum: 27 years, mean: 6.3 years), which includes 16 of the new 19 locations in Colorado reported here (1 Jackson County collection, 8 of the 2022 Larimer County collections, and 7 of the 2024 Larimer County collections).

# Natural southward expansion, fire-follower, or seed contamination?

The new occurrences of *Logfia arvensis* reported here raise questions about why and how propagules of this species are being transported into new areas in North America. As an introduced species, NatureServe (2024) indicates that it has gradually expanded its distribution in the USA. We propose that dispersal vectors and ecological opportunity offer three plausible explanations for the southward expansion into Colorado. We suggest that these new populations were founded through long-distance dispersal rather than landscape-scale movement (Essl et al. 2019) — since the nearest L. arvensis population is over 180 kilometers away in Wyoming — either by natural long-distance dispersal or human-mediated long-distance dispersal.

First, we hypothesize that natural long-distance dispersal could explain this range expansion. Morefield (2006) has suggested that avian dispersers may harvest Logfia plants' shoots for nest construction, facilitating additional dispersal opportunities. Even so, extreme wind events or animals might disperse L. arvensis seeds this distance (Nathan 2006), and habitats of southeastern Wyoming are similar to those in north-central Colorado,

Second, many of the new collections were made in previously burned areas. While the habitat shortly following a fire might provide the ecological opportunity for this species (Essl et al. 2019), current fire management may explain the human-mediated vector, perhaps through attachment of fruits to wildfire crews' protective equipment or gear. The scabrid bristles of the pappus of this genus may attach readily to rough surfaces (Andres Sanchez et al. 2013), and Stroh (2015) suggested that secondary vectors of dispersal for a sister species is adhering to "the tyres and equipment of farm machinery" (p. 2). We found that 11% of all USA collections of L. arvensis have been collected within a post-fire habitat in the last 21 years, and 84% of the new locations reported here occur within postfire habitat. Firefighters and land management try to mitigate the inadvertent spread of species on their equipment through weed-washing stations or through the use of resource protective measures (Cal-IPC 2022; Zorn 2020).

Third, a possible source of movement could be the result of inadvertent human introduction through timber harvest or sowing of seeds for site rehabilitation in the disturbed areas. Increased abundance of weedy species following certain timber harvest practices have been documented elsewhere (Scherer et al. 2000). Further, after a fire or other ground disturbance (e.g., timber harvest, overgrazing, resource extraction), land management professionals aim to stabilize soil structure and enhance ecological stability by seeding disturbed areas (Beyers 2004), although land managers often take precautions to avoid such introductions (e.g., verifying pure seed sources via certified weed-free restoration materials). In our 2024 collections, we sampled seeded and adjacent unseeded sites and found that 88% of seeded sites contained *L. arvensis*, while none of the unseeded sites, less than a kilometer from the seeded paired plots, contained *L. arvensis*.

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