SPECIES FACT SHEET

Common Name: A Farulan Caddisfly
Scientific Name: *Farula constricta* (Wiggins and Wisseman 1992)
Phylum: Mandibulata
Class: Insecta
Order: Trichoptera
Family: Uenoidae
Subfamily: Uenoinae

Conservation Status:
Global Status (2007): G1
Rounded Global Status: G1- Critically Imperiled
National Status (United States): N1
State Status (Oregon): S1 (Critically imperiled because of extreme rarity or some other factor(s) making it especially vulnerable to extirpation or extinction)
(NatureServe 2008)

Technical Description:
Adult: a small, moth-like insect, uniform dark brown in color, with a forewing length of 5 mm (0.2 in.) in both sexes (Wiggins and Wisseman 1992). Adults are typical for the genus in general structure, and have the curved and heavily setate internal branches of segment X, and the swollen mesal lobe of the inferior appendages also seen in the closely related *F. rainieri*. *Farula constricta* is distinguished by a sharp restriction in the mesal lobes of the inferior appendages, and by a constriction at the base of the internal branch of X, both in ventral aspect. The male genitalia are characterized as follows: segment IX recessed into VIII, dorsum incomplete, semi-membranous posterolaterally; divided dorsum of IX covered by thin irregular membrane which also overlies bases of internal branches of X; inferior appendages as in *F. rainieri*, base of mesal lobe broad but abruptly constricted to slender pointed apex in ventral aspect; lateral lobe of inferior appendages with setae denser and longer towards clavate apex. Segment X with internal branch much shorter than external branch, constricted basally in lateral aspect, greatly enlarged toward apex, sharply angulate in dorsal aspect, mesal surface bearing many stout setae toward apex; external branch of X about one and one-half times longer than internal branch, slender, with sharp apical point directed mesad; inferior branch of segment X heavily sclerotized, terminating in pair of blunt hooked processes, and with a broad point at each side near base; prenal appendages setate, rather small. Phallus typical for *Farula*, spoon-shaped dorsally with slender sclerotized tube at the apex. The female genitalia are typical for the genus and not distinguished from other species (Wiggins and Wisseman 1992).

Immature: Although the larvae of this species are known, a complete description is not available at this time (Wisseman 2008, *pers. comm.*). Larvae of the genus *Farula* make extremely slender portable cases, lack abdominal gills, and their sclerotized parts are mostly uniform dark brown or black (Wiggins 1996). The smoothly textured cases, so slender they could be mistaken for pine-needles (Wiggins 1996), are constructed of small sand grains fitted closely together and covered externally and internally with a thin silken lining (Wiggins 1996, Merritt et al. 2008). Cases can be up to 14.5 mm (0.6 in.) in length. *Farula* is further distinguished from other genera in the Uenoidae family by the following characters: pronotum broadest anteriorly in dorsal aspect, mesonotal sclerites with anterior margin rounded and single median notch between two sclerites, pronotum with anterior margin and anterolateral corner curved, darkened posterolateral corner of each mesonotal sclerite not reaching the mid-lateral point of sclerite, abdomen with filaments of lateral fringe scattered and arising over less than half of most segments, but with prominent and discrete tuft of filaments at the anterior edge of segment II (Wiggins 1996).

Pupa: In this genus, larval cases are converted into pupal chambers by a silken sieve membrane spun across the inside posterior opening of the case (Wiggins 1996).

Life History:

Most trichopterans in temperate latitudes are univoltine (Wiggins 1996), developing from the egg through five larval instars, pupating and emerging as adults within a single year. Larval diet of this species is unknown, but the larvae of other members of the genus are classed as collectors, scrapers, and gatherers, feeding on periphyton and organic particles from rocks (Wiggins 2004). Studies examining gut contents of *Farula* species revealed mostly fine organic particles with some filamentous algae and fine rock fragments. *Farula* larvae pupate in aggregations on the undersides of rocks and logs (Applegarth 1995, Wiggins 1996). Larvae and pupae of this species have been collected in March and April, and pupae collected at this time have also been reared to adults. Adults have been collected from March through May (Wiggins and Wisseman 1992, Wisseman 2008, *pers. comm.*). The flight periods of other Oregon *Farula* species range from April to June.

Range, Distribution, and Abundance:

This rather recently described species is known only from four to five small streams in the Columbia River Gorge (Hood River County: Eagle Creek (2003); Multnomah County: Mist Falls near Wahkeena Creek (1989); Oneonta Creek in Oneonta Gorge (2003); a small unnamed stream 0.9 miles west of Oneonta Creek (1989); and a stream between Multnomah Falls and Oneonta Falls (2003, possibly the same stream as the 1989 record)). Although it is possible that the species is extremely isolated in its distribution and confined to a few

short reaches of the above streams (Wisseman 2006, *pers. comm.*), further surveys in small, nearby streams may reveal additional populations.

Forest Service/BLM lands: Documented occurrences are in the Columbia River Gorge National Scenic Area/Mount Hood National Forest.

Habitat Associations:
The species is known from small, cold-water streams in the Columbia River Gorge. The elevations of the sites, where documented, range from 122 to 213 m (400 to 700 ft.) (Wiggins and Wisseman 1992).

Threats:
Most trichopteran species have highly specific preferences with regard to water temperature, velocity, dissolved-oxygen levels, and substrate characteristics, and are therefore sensitive to a wide array of habitat alterations. Sedimentation, eutrophication, and chemical pollution caused by road construction and impervious surface run-off could impact this species. The scenic and heavily trafficked Historic Columbia River Highway crosses most, if not all, of the streams occupied by this species, and current road construction at the Oneonta Creek bridge may impact the Oneonta population of this species. Ongoing work at this site involves construction of a paved parking area east of the Oneonta Tunnel, and reconstruction of the tunnel (Friends of the Historic Columbia River Highway, 2008).

Both Oneonta Gorge and Eagle Creek are among the most popular hiking and camping destinations in the Columbia River Gorge (USFS 2007), and recreational use at these sites is expected to intensify in the future, due to both local population growth and national recreation trends (Cordell *et al.*, 1996). Sedimentation and bank erosion by heavy recreational activity, as well as recent landslides (Salem-News 2008), could impact this species.

The loss of trees through timber harvest poses additional threats, since this species occupies forested habitats, and trees provide shade that maintains appropriate water levels and temperatures for larval and pupal development. Continued global climate change raises further issues for this cold-water species: projected changes from this phenomenon include increased frequency and severity of seasonal droughts and flooding, reduced snowpack to feed river flow, increased siltation, and increased air and water temperatures (Field *et al.* 2007), all of which could unfavorably impact this species' habitat and long-term survival.

Conservation Considerations:
Inventory: Further surveys at and around the known sites are needed to help establish the current status of this species. Similar cold-water streams in the region (Mt. Hood National Forest and Columbia River Gorge) should also be explored for suitable habitat, and surveyed for this species. Since population

size is important in evaluating the stability of a species at a given locality, abundance estimates of this species would also be valuable.

Management: Protect all new sites and their associated watersheds from heavy recreational use, timber harvest, and other practices that would adversely affect aspects of this species' life cycle. Undisturbed buffers of coniferous forest around stream habitat may be critical for the survival of species within the *Farula* genus (Applegarth 1995). Riparian habitat protection, including maintenance of water quality, substrate conditions, and canopy cover, would likely benefit and help maintain this species.

Version 2:
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Date: December 2008

Version 1:
Prepared by: Eric Scheuering
Date: January 2006

ATTACHMENTS:

(1) References
(2) List of pertinent or knowledgeable contacts
(3) Trichoptera Survey Protocol, including specifics for this species

ATTACHMENT 1: References:

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Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J. and Hanson, C.E., eds.). Cambridge University Press, Cambridge, UK. Available at: www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter14.pdf.

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Wisseman, R.W. 2006. Personal communication with Eric Scheuering.

Wisseman, R.W. 2008. Personal communication with Sarah Foltz.

ATTACHMENT 2: List of pertinent, knowledgeable contacts:

Robert Wisseman, Aquatic Biology Associates, Inc. Corvallis, OR.

ATTACHMENT 3: Trichoptera Survey Protocol, including specifics for this species:

Survey Protocol

Taxonomic group:
Trichoptera

Species:
Agapetus denningi
Farula constricta
Farula davisi
Namamyia plutonis
Rhyacophila colonus

Where:
Trichopterans utilize a diversity of fresh water aquatic habitats, including headwater springs, streams, rivers, lakes, marshes, seepage areas, ponds, hot springs, and temporary pools. Most species have highly specific preferences with regard to water temperature, velocity, dissolved-oxygen levels, and substrate characteristics. Since the case-making larvae generally specialize in certain types of building material, the size and composition of available organic and inorganic materials can largely limit species' distributions. Construction materials include sand, pebbles, small rocks, mollusk shells, algae, duck-weed, plant stems, pine-needles, bark, grasses, and dead leaves. Some species are more selective than others and a few even exhibit life-stage-specific specialization, changing the case material and design partway through their aquatic life. Additionally, trichopteran larvae are often highly specialized in their dietary preferences and in the manner and location in which food is obtained. For species-specific construction material, feeding behavior, and habitat information, see the section at the end of this protocol.

When:
Adults are surveyed in the spring, summer, and fall, within the window of the species' documented flight period. In temperate climates, adults of various species can be collected from ice-break until the first days of heavy frost (Canton and Ward 1980). Larvae and pupae are most conveniently surveyed at the same time as adults.

Adults:
Adult trichopterans are predominantly encountered in the vicinity of water, close to their emergence or oviposition site. Dispersal from the emergence site appears to be negatively correlated with vegetation density along the dispersal corridor; adults disperse farther (up to around 200 m (656 ft.) in sparsely vegetated areas (Collier and Smith 1998). In general, searches will be most productive within 30 m (98 ft.) of the water edge (Collier and Smith 2004).

Adults are frequently collected from riparian vegetation with an aerial sweep net; they can also be hand-picked from the undersides of bridges and culverts, and from the sides and upper-surfaces of partly-submerged logs. Additionally, adults can often be collected in large numbers in soapy-water pan traps placed under a light (e.g. a vehicle headlight) and left overnight. Specimens can also be collected at night directly from lights or an illuminated sheet using an aspirator or finger dipped in alcohol. An aspirator is especially useful for capturing small species. Some species (such as members of the *Rhyacophila*) are attracted to ultraviolet light. Emergence traps placed over habitat where the larvae are known or suspected to occur are another good method for obtaining adults (Wisseman 2005, *pers. comm.*). For emergence trap designs and sampling information, see Davies (1984). Additionally, sticky traps constructed from 5-gallon buckets lined with non-drying glue are effective at capturing adults of some species (Applegarth 1995).

Adults should be killed and preserved in 80% alcohol, or killed in cyanide and transferred to alcohol. Cyanide-killed adults may also be pinned, particularly to preserve color patterns, but pinning often damages critical aspects of the thorax and dried specimens are very difficult to identify to species (Triplehorn and Johnson 2005).

Since trichopteran identification often involves close investigation of adult male genitalia, photographs and sight records will not provide sufficient evidence of species occurrences. However, such observations may be valuable in directing further study to an area.

Larvae and pupae:

The aquatic larvae and pupae are found underwater, often creeping slowly along the substrate, or attached to rocks. In streams and springs, it is best to search for larvae and pupae on the undersurface of large rocks and in the smaller substrate underneath the rocks. Since some species pupate in clusters, it may be necessary to turn over many rocks before finding a cluster. Grazing larvae frequently occur in mosses and liverworts growing on the tops of rocks, and in the thin layers of water running over rocks. In seepage areas at the head of springs, particular attention should be given to washing and searching samples of water-saturated organic muck (Wiggins 1996). In the heavily vegetated areas of lake shores, ponds, and marshes, larvae can be found in the substrate and crawling on aquatic plants. In deeper parts of lakes, larvae occur in surface mat plants, such as *Ceratophyllum*, and in soft bottom materials (Wiggins 1996).

When surveying for larvae, care must be used to avoid disrupting stream banks, shorelines, vegetation, and habitat. Depending on the habitat, a variety of nets can be useful. D-frame nets with mesh size fine enough to retain small larvae (0.5 mm, 0.02 in.) are the most versatile, as they can be used in both

lotic and lentic habitats. In stream systems, the standard kick-net technique can be applied. The net is held vertically with the opening facing upstream and the flat side pressed tightly against the bottom substrate, so that water flows neither under nor over the net. Large rocks and wood immediately upstream of the net are gently scrubbed by hand or with a soft brush and the bottom substrate is disturbed with the hands, feet, or a stick while the current carries the uncovered and dislodged insects and material into the net. The stream bottom is disturbed to a depth of 4 – 6 cm (1.2 – 2 in.) for about three minutes, following which the net is removed from the water for specimen retrieval. When lifting the net, the bottom of the frame is swept forward in a scooping motion to prevent insects from escaping. Net contents are then flipped or rinsed into shallow white trays to search for larvae more easily, as they are often quite cryptic and can be difficult to see if they are not moving. In addition to nets and shallow trays, the following equipment is also useful: fine-mesh strainers/sieves for washing mud and silt from samples, squirt bottles for rinsing the net, five-gallon buckets for holding rinsing water, and white ice-cube trays, forceps, and a hand lens for sorting insects.

Larvae and pupae should be preserved on-site in 80% alcohol, unless collection for rearing is an objective. Since most trichopteran species have not been described in their larval stage, rearing can be critical in both (1) enabling species identification and (2) providing novel associations of larvae with adults. Wiggins (1996, pages 37-38) provides a summary of the accepted methods for immature-adult associations in caddisflies. Generally, in order to maximize the amount of information that can be gained from collected specimens, as many life stages as possible should be collected and a portion of both the larval and pupal series reared to adulthood. While pupae can be reared in small, refrigerated containers containing damp moss, larvae require an aerated aquarium with isolated cages for individuals. An oxygen bubbler generally provides sufficient oxygen and current, although some species (e.g. members of the Hydropsychidae) may require unidirectional current. Detailed techniques for rearing stream-dwelling organisms in the laboratory, including transportation, aeration, current production, temperature control, food, and toxic substances, are provided by Craig (1966), and available online at http://www.nzetc.org/tm/scholarly/tei-Bio14Tuat02-t1-body-d1.html (last accessed 19 November 2008).

Although quantitative collecting of trichopterans is difficult, population-size data is important in evaluating a species' stability at a given locality and in assessing its conservation needs. Relative abundances of immature trichopterans can be estimated by using a uniform collecting effort over a given sample period at comparable habitats (Wiggins 1996). The area or volume of substrate samples can also be standardized, although the aggregated spatial distributions of many species (e.g. Schmera 2004) can complicate this approach.

While researchers are visiting sites and collecting specimens, detailed habitat data should also be acquired, including substrate type(s), water temperature, water source, water velocity, water depth, stream width, canopy cover, streamside vegetation density, and degree of human impact. Algal or cyanobacterial blooms and other signs of eutrophication should be watched for and noted.

Species-specific Survey Details:
Farula constricta

This species has been recently collected from four to five small streams in the Columbia River Gorge (Hood River County: Eagle Creek (2003). Multnomah County: Mist Falls near Wahkeena Creek (1989); Oneonta Creek in Oneonta Gorge (2003); a small unnamed stream 0.9 miles west of Oneonta Creek (1989); and a stream between Multnomah Falls and Oneonta Falls (2003, possibly the same stream as the 1989 record)). Although it is possible that this species is extremely isolated in its distribution and confined to a few short reaches of the above streams (Wisseman 2005, *pers. comm.*), further surveys in small, nearby streams may reveal additional populations. Additionally, since populations of this species may be negatively impacted by timber harvest, road construction, recreation, and other activities that degrade stream habitat, re-evaluation of this species' status at the known sites (particularly those surveyed in 1989) is critical in identifying the species' current distribution and conservation needs.

Surveys of this species should be conducted between March and May (Wiggins and Wisseman 1992, Wisseman 2008, *pers. comm.*). The elevations of the documented 1989 sites range from 122 to 213 m (400 to 700 ft.) (Wiggins and Wisseman 1992). Sweep-netting of streamside vegetation and handpicking of adults from streams where *Farula* larvae are found are the most direct survey procedures for this species (Wisseman 2005 *pers. comm.*). Adults do not appear to respond to ultraviolet light. If adults are not found, pupae can be collected and reared to adulthood, or emergence traps can be placed over known larval habitats to obtain adults (Wisseman 2005 *pers. comm.*). Pupae in this genus are found attached to the undersides of rocks and logs (Applegarth 1995).

Adults of this species are uniform dark brown in color with forewing lengths of 5 mm (0.2 in.). The smoothly textured larval cases are constructed of small sand grains fitted closely together, and are so slender they could be mistaken for pine-needles. Since the larvae, pupae, and adult stages of this species have been positively associated (Wiggins and Wisseman 1992, Wisseman 2008, *pers. comm.*), rearing the aquatic stages to adulthood is not critical for association purposes. Adult specimens, however, would aid in the identification process.

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Wisseman, R. 2008. Personal communication with Sarah Foltz.