Plant Adaptations and Fire

by Ellen Kuhlmann, Koma Kulshan Chapter

Plants experience variability in their environment, including changes in temperature, moisture, and nutrients as well as disturbances such as landslides, floods, and fires. Over time plants with morphological or physiological traits that help the plant tolerate or adapt to these changes tend to increase in number. Sometimes a trait that evolved for one reason is useful for responding to other situations. Given that many extant adaptations developed in the past, scientists can only hypothesize as to the exact reason why a particular trait developed. Whether the traits discussed below developed in response to fire is uncertain; however, it is known that they are advantageous in surviving and/or recovering from fire.

Bark thickness is one trait that affects resistance to fire damage. Species with thin bark are highly susceptible to fire-caused mortality. Fire-adapted species such as ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudostuga menziesii*) have thick bark that does not burn easily and reduces the amount of heat transferred to the vascular cambium, located beneath the bark. Vascular cambium forms both phloem and xylem, the living tissues that transport water and nutrients.

Resprouting. Many species have the ability to grow new shoots after damage to the aboveground portion of the plant. These plants resprout from buds in the root crown, along rhizomes, or from other belowground structures. Since these buds are beneath the soil surface they are protected to some degree from fire damage. Whether they survive depends on how hot the fire is and how long it burns. Bigleaf maple (*Acer macrophyllum*), aspen (*Populus tremuloides*), and pinegrass (*Calamagrostis rubescens*) are examples of species that often regenerate after a burn by resprouting.

Closed or serotinous cones often stay on a tree after the seed matures, the cone scales sealed by resin. These seeds remain viable due to the cone's connection to the tree's vascular system. Serotinous cones can remain on a tree for decades until conditions trigger cone opening. When a fire sweeps through a stand of trees with closed cones, the fire's heat melts the resin. If the tree dies nutrient flow to the cone ceases, and the cone opens, disseminating seed. Lodgepole pine (*Pinus contorta* var.

Pinegrass in flower, near Naneum Meadow, October 2013. Pinegrass is rarely found in flower except in recently burned areas. PHOTO: ELLEN KULHMANN

Rose (*Rosa* sp.) resprouting in April of 2013, Hayward Hill, Kittitas County. The Taylor Bridge fire swept through the area the previous summer, killing the aboveground portion of the shrub. PHOTO: ELLEN KUHLMANN

latifolia) has both closed and open cones, allowing for regular as well as fire-stimulated seed dispersal.

Seed germination. The seeds of some plants can remain dormant (viable but not germinating) for long periods of time well after dispersal, germinating only after the seed coat is scarified (damaged) or dormancy is broken by some other mechanism. These seeds generally possess an impermeable seed coat, which helps in the retention of chemicals that maintain dormancy. Heat from fire can crack the seed coat, allowing the chemical inhibitors to exit and germination to occur. Species with this type of seed are common components of the postburn plant community. Dormancy can also be affected by smoke and other aspects of fire, such as time of year and duration. Two species with seeds that germinate postfire are longsepal globemallow (*Iliamna longisepala*) and snowbrush (*Ceanothus velutinus*).

The aforementioned traits are some of the ways plants respond to fire directly. Fire also affects plants indirectly, such as by increasing light availability through a reduction in canopy cover, creating gaps of bare soil, and by changing soil properties. Species such as pinegrass (*Calamagrostis rubescens*) respond to increased light availability by flowering. Bare soil is readily colonized by species such as fireweed (*Chamerion angustifolium*) that have lightweight, wind-disseminated seeds. Species that can fix nitrogen such as lupines (*Lupinus* spp.) often increase after high-severity fires because they can grow in nitrogen-deficient soils. Nitrogen is often volatilized during high-severity fire.

The interactions between fire and plants are complex, with both the direct and indirect effects of fire operating at multiple scales in time and space. By examining how plants respond to fire we can learn how to better manage fire prone landscapes, fostering increased plant community resiliency and health.

WASHINGTON'S RARE PLANTS

Longsepal globemallow (*Iliamna longisepala*)

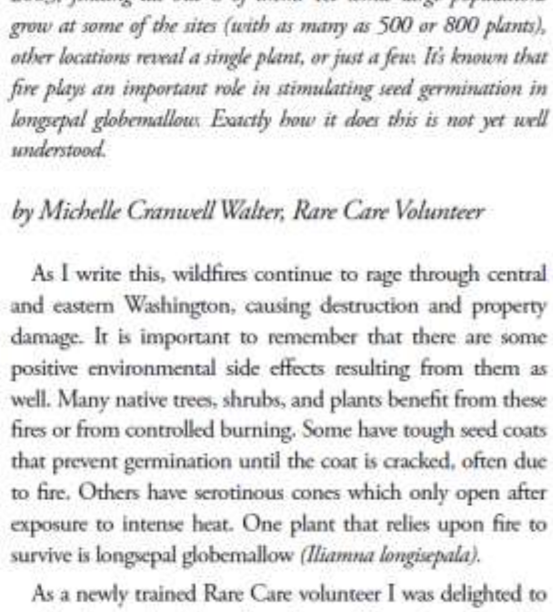
Washington State Sensitive Species

Nearly 80 occurrences of Iliamna longisepala *have been documented in Chelan, Kittitas, and Douglas Counties. Rare Care volunteers have visited about 20 of these occurrences since 2003, finding all but 6 of them. Yet while large populations grow at some of the sites (with as many as 500 or 800 plants), other locations reveal a single plant, or just a few. It's known that fire plays an important role in stimulating seed germination in longsepal globemallow. Exactly how it does this is not yet well understood.*

by Michelle Cranwell Walter, Rare Care Volunteer

As I write this, wildfires continue to rage through central and eastern Washington, causing destruction and property damage. It is important to remember that there are some positive environmental side effects resulting from them as well. Many native trees, shrubs, and plants benefit from these fires or from controlled burning. Some have tough seed coats that prevent germination until the coat is cracked, often due to fire. Others have serotinous cones which only open after exposure to intense heat. One plant that relies upon fire to survive is longsepal globemallow *(Iliamna longisepala)*.

As a newly trained Rare Care volunteer I was delighted to receive longsepal globemallow for my first assignment. My population included five sites along and near a creek near



Stems of longsepal globemallow have coarse, stiff hairs plus shorter, fine hairs. Leaves have petioles and stipules, with blades 4 to 10 cm long. PHOTO: MARK THOMPSON