

Appendix B. Invasive Species Removal Techniques

Manual Control

- Hand pulling: pulling entire plant from ground using hands or weed wrench. This is the most commonly used method for controlling invasive plants in the GGNRA. It is best used for species that are either shallowly rooted or with tap root easily pulled from the ground. This is an excellent technique for volunteers and is minimally invasive. Examples include iceplant (*Carpobrotus edulis*) and French broom (*Genista monspessulana*).
- Cutting: cutting stems using loppers, hand shears, or handsaws. This treatment is commonly used for removing inflorescences to minimize the seed crop of an invasive species or for tree like species that are not known to resprout. This is an excellent technique for volunteers and is minimally invasive, involving no ground disturbance or impacts to non-target species. Examples include removing plumes from large pampas grass (*Cortaderia jubata*) or controlling Monterey pine (*Pinus radiata*) or cypress (*Cupressus macrocarpa*) saplings.
- Grubbing: using hand tools to dig out plants. This treatment is commonly used to dig out plants that cannot be easily hand pulled using a weed wrench or by hand. It entails more ground disturbance than the above treatments and it is more difficult to ensure that the entire root is removed. Examples where grubbing may be successful include pampas grass (*Cortaderia jubata*), purple star thistle (*Centaurea calcitrapa*), tocalote (*Centaurea melitensis*), Italian thistle (*Carduus pycnocephalus*), cape ivy (*Delairea odorata*), and sweet fennel (*Foeniculum vulgare*).

Mechanical Control

- Scorching: apply heat to seedlings with propane torch. Effective for controlling cotyledons and small seedlings of invasive plants, especially in areas with otherwise low vegetative cover. Examples include French broom (*Genista monspessulana*) seedlings.
- Brushcut or Mow: mechanical equivalent of cutting, but faster. Excellent for controlling large patches of plants that respond to cutting or for eliminating inflorescences from mature plants before they set seed. Examples include annual and perennial grasses, other annual or biennial species.

Chemical Control

- Spot / wick application: spray or sponge a dilute amount of NPS approved herbicide to growing foliage. These methods are only employed for plant species or plant stages that cannot be effectively removed by manual or mechanical means because they resprout, because ground disturbance entailed is unacceptable, or because other means of removal would pose a threat to worker safety. Wick application is less commonly used, but has substantially less non-target impact due to its direct application. Further, herbicide can be applied specifically to the upper foliage in order to prevent small mammals, reptiles, and amphibians from coming directly into contact with herbicide. Examples include large plants of sweet fennel (*Foeniculum vulgare*), large patches of pampas grass

(*Cortaderia jubata*), bristly ox-tongue (*Picris echioides*), and plants occurring on steep slopes or in poison oak thickets.

- Cut and treat stump with herbicide: cut stems as above then apply a small amount of NPS approved herbicide to cut stump or stem. This method is employed for certain shrub species at locations where ground disturbance caused by hand pulling or grubbing is unacceptable. It is also used for tree species that resprout after being cut. Examples include Eucalyptus (*Eucalyptus globulus*), Cotoneaster (*Cotoneaster pannosa*), and French broom (*Genista monspessulana*).

Note: All herbicide use would be implemented consistent with the NPS Integrated Pest Management (IPM) Program (<http://www.nature.nps.gov/biology/ipm/>). IPM is a science-based, decision making process that coordinates knowledge of pest biology, the environment and available technology to prevent unacceptable levels of pest damage, by cost-effective means, while posing the least possible risk to people, resources and the environment. The IPM Process reviews all available tools suitable for managing the specific pest species in each situation and selects for use the least toxic and effective method. Pesticides and biological control agents proposed for use on NPS lands must be submitted to the park IPM Coordinator for review by Washington Service Office or Regional IPM Coordinators.