



Imazapyr: Low Impact Tool for Invasive Spartina Control in the San Francisco Estuary



Above: Clones of hybrid *Spartina* look like bacteria in a petri dish, expanding out along the mudflats of the Alameda County Flood Control Channel, with a meadow of coalesced clones behind. **Below:** Dense infestation of hybrid *Spartina* choking the south channel of Old Alameda Creek, illustrating the impacts to flood control capacity as well as the loss of salt marsh habitat.



Above: Invasive *Spartina* threatens to colonize thousands of acres of mudflats that are essential foraging habitat for millions of migratory and resident shorebirds and waterfowl. **Below:** Endangered California clapper rail forage in channel habitat and nest in native gumplant (*Grindelia stricta*) and pickleweed (*Salicornia virginica*) marsh, both of which are excluded by invasive *Spartina*.



The San Francisco Estuary has been invaded by four aggressive species of non-native cordgrass (*Spartina*) that pose serious threats to salt marsh habitat for several endangered species as well as millions of migratory and resident shorebirds and waterfowl. These invaders also spread their direct impacts to humans by reducing flood control capacity and creating mosquito-breeding areas in the marsh. The Invasive *Spartina* Project (ISP) of the State Coastal Conservancy is coordinating a regional effort to control the spread of these invaders and eventually eradicate them from the Estuary. The current scope of the *Spartina* problem in 2006 is approximately 1,500 acres within 16,000 acres of salt marsh and brackish channels.

The Coastal Conservancy approved the use of imazapyr herbicide by ISP's partners through an addendum to the project's Programmatic Environmental Impact Report (prepared under the California Environmental Quality Act). The addendum considered detailed scientific data concerning the potential impacts of imazapyr on biological resources and on humans. Imazapyr is a systemic aquatic herbicide approved by the U.S. Environmental Protection Agency (EPA) and the State of California for use in sensitive estuarine environments. It has become the ISP's preferred *Spartina* control method in many cases because it is very effective and causes the least impact to the marsh of any method. Other methods, such as excavation or covering with a tarp, can leave lasting scars in the marsh, particularly when applied to more than a very small area. In addition, excavated plants must be hauled out of the marsh (lest they re-root and continue to spread), making the work of manual removal much more time consuming and hazardous to workers. Manual removal of *Spartina* is an important part of the ISP's control strategy at appropriate sites, and it will continue to be used following herbicide treatment at large sites to help complete eradication.

Imazapyr is applied to the leaves of the target plant, absorbed into the circulatory system of the plant, and sent down into the roots to permanently kill the vegetation. Imazapyr works to prevent the synthesis of three amino acids produced only by plants which are required for their growth and maintenance. Treated *Spartina* will first show some yellowing after a couple weeks, and will gradually turn brown over the next month. The results of late summer applications may appear similar to the natural seasonal die back of a perennial plant like *Spartina*, but most of the treated plants should not return the following spring.

Imazapyr, sold under the trade name Habitat® (manufactured by BASF), has a very low toxicity to fish, birds, insects, mammals, and aquatic invertebrates (an important building block for the Estuary's food web). Since imazapyr is designed to work specifically on plant processes, it poses little risk to animals because they don't contain these same pathways. Even direct contact with the herbicide mixture during treatment should be harmless to wildlife. There is a very large margin of safety between the maximum concentration of imazapyr that occurs following application and the concentrations that could result in toxicity to invertebrates and fish.



Left: Applying imazapyr to invasive *Spartina* from amphibious tracked vehicle with a stand of shorter native *Spartina* in the foreground. **Below:** Applicator treats a meadow of *Spartina* with imazapyr by hauling a hose from a truck in the adjacent upland. Notice that a harmless blue dye is normally added to assist the applicator in getting complete coverage. **Right:** The endangered salt marsh harvest mouse lives in native pickleweed and would be heavily impacted by large-scale excavation or covering as a control method.



When selecting *Spartina* control tools, the ISP also considers potential impacts to human health and safety, both for the general public and for the applicators. An independent evaluation of the use of imazapyr for *Spartina* control in the San Francisco Estuary concluded that neither workers nor members of the public would be at any substantial risk from acute or longer-term exposure to imazapyr. Applications normally occur only once a year on a site, so there is no opportunity for long-term chronic exposures. Imazapyr is not a carcinogen, mutagen, teratogen or endocrine disruptor.

As the saying goes, "dose makes the poison". Even caffeine, aspirin and table salt can produce toxic effects in high enough quantities. Each of these common household substances are toxic to animals at **lower** amounts than with imazapyr. At the standard application rate of 1.5%, an average-sized person would have to drink 25 gallons (400 cups) of imazapyr mixture to reach lethal levels. At the highest application rate, an applicator would have to wear a contaminated glove for 50 hours or 2 days to reach a level of concern. Consequently, U.S. EPA and the State of California also place no post-treatment restrictions on recreational use of the adjacent surface waters for swimming, fishing, etc.

An important measure of potential long-term risk posed by an herbicide is how persistent it is in the environment. Sunlight breaks down imazapyr very quickly in water, within an average of 40 hours, and it has also been shown to disappear from mudflat sediment within an average of 400 hours. In addition, imazapyr does not bioaccumulate or increase in concentration by moving up the food chain. Since it passes quickly through the body of aquatic animals and is eliminated, neither birds nor larger fish are going to be impacted by eating lots of smaller fish exposed to the herbicide.

Photo credits: California clapper rail - Peter LaTourrette, Salt marsh harvest mouse - Joe DiDonato (EBRPD), all other photos from Invasive *Spartina* Project (Drew Kerr)

References:

- Leson & Associates. 2005. Use of Imazapyr Herbicide to Control Invasive Cordgrass (*Spartina* spp.) in the San Francisco Estuary: Water Quality, Biological Resources, and Human Health and Safety.
- Patten K. 2003. Persistence and non-target impact of imazapyr associated with smooth cordgrass control in an estuary. Journal of Aquatic Plant Management, vol. 41, pp. 1-6.
- SERA (Syracuse Environmental Research Associates, Inc.). 2004. Imazapyr - Human Health and Ecological Risk Assessment – Final Report, prepared for USDA, Forest Service, December 18, 2004.

Invasive *Spartina* Project



SAN FRANCISCO
ESTUARY INVASIVE
SPARTINA PROJECT

Preserving native wetlands

Invasive *Spartina* Project
2560 9th St., Ste. 216
Berkeley, California 94710

Phone: 510-548-2461
Fax: 510-548-2460

www.spartina.org



The San Francisco Estuary Invasive *Spartina* Project is a project of the State Coastal Conservancy, managed by Conservancy staff and by independent contractors under their supervision.

Please let us know if you find any non-native *Spartina* species

Include the following information:

- *Spartina* species
- Location (GPS coordinates if possible or drawing on a topographic map)
- Approximate size of plant/clone or population
- Date seen
- Your name and contact information
- If possible, please include a photo to help with identification

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