

<http://www.alt2tox.org/pdfs/Kegley-Feb08.pdf>

From the expert declaration of Dr. Susan Kegley on behalf of Californians for Alternatives to Toxics for the Humboldt County Superior Court:

Imazapyr is highly mobile and persistent in the environment.

Imazapyr is highly mobile and quite persistent in the environment, two factors that contribute to the ability of this herbicide to cause long-term impacts on non-target plants near treated sites [*on the main stem and south forks of the Eel River for the Purple Loosestrife Project*].

Laboratory studies show that imazapyr is essentially stable under most environmental conditions and is not degraded by hydrolysis, aerobic or anaerobic soil degradation, or by aerobic and anaerobic aquatic metabolism. Aerobic soil half-lives are estimated at 1.2 years to 5.9 years. Photolysis in water is the only significant degradation pathway (half-life 2–5 days), but this process requires the pesticide to be dissolved in clear water and exposed to strong sunlight. The persistence of imazapyr has been well-documented; field studies on residual activity of imazapyr demonstrate that areas treated with imazapyr were still toxic to all plants tested (primarily food crops and forage grasses) one year after treatment. Laboratory studies show substantial plant growth inhibition at very low concentrations of imazapyr.

In summary, imazapyr is very persistent in the environment, highly water soluble, and does not absorb well to most soils. Thus, any imazapyr released into the environment will readily be transported off site by precipitation, flooding or irrigation runoff. Imazapyr's mobility and persistence, combined with an annual treatment regime that is intended to last for 2–10 years will likely result in widespread collateral damage to other plants that are downgradient from the treated area. Reestablishment of native species will be difficult in areas with residual imazapyr in the soil.

Broad-spectrum effects of imazapyr and damage to non-target plants.

Because imazapyr is a non-selective, broad-spectrum herbicide, drift and/or runoff to non-target plants will cause damage near application sites. U.S. EPA's risk assessment for imazapyr indicates that non-crop uses of imazapyr by ground spray are likely to exceed EPA's Levels of Concern ("LOC") for non-target plants as a result of runoff and spray drift. Herbicide damage to non-target plants increases their susceptibility to disease and will interfere with their ability to compete successfully with other plants.

Of particular concern are endangered plant species that may be affected by drift or runoff from treatment sites, as the loss of just a few individuals may endanger the survival of the entire population. In the Eel River watershed, Beach layia (*Layia carnosa*), an endangered native plant, may be affected by the herbicide applications, as may be the Humboldt County fuschia (*Epilobium septentrionale*), a sensitive native plant species.

Potential for purple loosestrife resistance to imazapyr.

Imazapyr is an imidazolinone herbicide that belongs to a group of herbicides that act by inhibiting acetolactate synthase (ALS), an enzyme necessary for the production of essential amino acids within plants. At least 51 different herbicides currently in use are ALS inhibitors, approximately 25% of all herbicides now used. These herbicides fall into several different chemical classes, including imidazolinones, pyrimidinylthiobenzoates, sulfonylureas, sulfonylaminocarbonyl triazolinone, and triazolopyrimidines.

In 2000, there were 73 weed species worldwide that had developed resistance to ALS-inhibitor herbicides. By 2008, this number had increased to 95 resistant species worldwide.⁶ Cross-resistance between different ALS-inhibitor herbicides is a well-known phenomenon;⁷ thus for example, a plant that is resistant to a sulfonylurea herbicide is likely to also be resistant to an imidazolinone herbicide because the mechanisms of action of the two herbicides are similar. The result is widespread and increasing weed resistance to ALS inhibitors, with overall herbicide resistance increasing exponentially.

In California, one member of the loosestrife family (Lythraceae)—the long-leaved loosestrife (*Ammania coccinea*)—has already developed resistance to the ALS-inhibitor bensulfuron-methyl, an herbicide used in rice. In California, bensulfuron-methyl was introduced in 1989, and resistance in long-leaved loosestrife was first noted in 2000. Further research indicates that this species may be cross-resistant to other ALS-inhibitor herbicides as well.

Resistance can develop quickly in areas with exclusive use of a particular herbicide. For the Smallflower Umbrella Sedge and Ricefield Bulrush, resistance to bensulfuron-methyl was documented in 95% of the rice-growing area only six years after its introduction.⁸ Resistance development is enhanced with long-soil-residual herbicides like imazapyr used at the same site year after year.

These data suggest that there is a substantial probability that purple loosestrife populations treated annually with imazapyr for 2-10 years may develop resistance to this herbicide, rendering the proposed eradication plan ineffective, while still presenting risks to non-target plants. Determination of “no significant impact” is based on apples to oranges comparisons.

The Humboldt County Notice of Exemption, “HCNOE”, indicates that the determination of “no significant impacts” was based on three risk assessments: 1) Use of Imazapyr Herbicide to Control Invasive Cordgrass (*Spartina* spp.) in the San Francisco Estuary, P. Pless et al., (AR 371-451) 2) Ecological Risk Assessment of the Proposed Use of the Herbicide Imazapyr to Control Invasive Cordgrass (*Spartina* spp.) in Estuarine Habitat of Washington State, Entrix, Inc. (AR 540-697) and 3) Imazapyr—Human Health and Ecological Risk Assessment—Final Report, US Forest Service (“USFS”) (AR 698-844). The stated conclusion is:

“... there is no evidence that significant impacts to biological resources or risks to human health and safety exist or that cumulative impacts will occur as a result of repeated herbicide applications. The Purple Loosestrife Project area is not significantly different from those areas studied in the above-referenced risk assessments and it can be reasonably assumed that the conclusions regarding the impact of imazapyr drawn in these risk assessments apply equally to the Purple Loosestrife Project area.”

There are several inconsistencies between this conclusion and the cited risk assessments. First, the USFS risk assessment was published in 2003, the same year that Habitat®, the aquatic use formulation of imazapyr, was first registered for use in the U.S. Thus, the USFS risk assessment does not evaluate risks from use of imazapyr-containing herbicides in and near aquatic habitats, and the assessment of risks of imazapyr use in upland forest settings is not directly comparable to risks of imazapyr use in aquatic and riverine settings. However, even the data in the USFS risk assessment from imazapyr use in upland forest settings indicates substantial concern for non-target plants that may be affected by runoff or drift, and the USFS guarantees no level of certainty that no significant impacts will occur.

“Imazapyr is an effective herbicide and even tolerant plants that are directly sprayed with imazapyr at normal application rates are likely to be damaged. Some sensitive plant species could be affected by the off-site drift or by off-site movement in runoff of imazapyr, depending on site-specific conditions. When applied to areas in which runoff is favored, damage from

runoff appears to pose a greater hazard than drift. Residual soil contamination with imazapyr could be prolonged in some areas. In relatively arid areas in which microbial degradation may be predominant factor in the decline of imazapyr residues in soil, residual toxicity to sensitive plant species could last for several month to several years. In areas of relatively high rainfall rates, residual toxicity to sensitive plant species would be much shorter. This characterization of risk for residual soil contamination is general rather than site-specific. The persistence and movement of imazapyr in soil is highly complex and substantially different estimates of persistence and transport could be made if different site-specific factors were considered. Thus, these estimates of risk should be considered only as crude approximations of environmentally plausible consequences.”

Finally, Habitat® was first registered in California in August of 2005, thus any long-term impacts of repeated use of imazapyr in aquatic environments cannot yet be assessed with any certainty.

The other two risk assessments cited in the HCNOE as evidence that no significant impacts would occur were conducted for cordgrass (*Spartina* spp.) control projects in tidal marshlands. When tidal marshlands are treated with an herbicide, the fate of the herbicide is quite different than that observed in a riverside setting. Studies tracking the fate and transport of imazapyr in tidal marshlands show that imazapyr concentrations are highest when the tide first comes in as the water initially washes over the treated area. The half-life of imazapyr in the treated part of the estuary of 1.6 days. In short, the incoming tide washes away the water- soluble imazapyr.

The purple loosestrife stands along the Eel River are very different environments from tidal marshlands. There is no regular flushing of the treated areas by the river. In fact, there are long dry periods followed by light rains in late summer and early fall, then heavier rains as the winter rainy season progresses. Because imazapyr has a very long half-life, substantial quantities of imazapyr will remain in treated areas for months, and will be transported downgradient from treated purple loosestrife stands in runoff, passing through other areas where non-target plants may be.

The conclusion of “no significant impact” is not justified because the information on which the decision was based is not applicable to the Eel River watershed. In my professional opinion, the use of imazapyr over time, as presented in the proposed eradication plan, may have significant environmental effects, as outlined above.

Susan E. Kegley, PhD, is Principal and CEO, Pesticide Research Institute, and Senior Scientist /Program Coordinator, Pesticide Action Network. Dr. Kegley is a nationally recognized expert on the environmental fate and toxicology of pesticides. Her website is available at <http://www.pesticidresearch.com/index.html>

Californians for Alternatives to Toxics filed suit against the California Department of Parks and Recreation for approving the Purple Loosestrife Project without complying with the California Environmental Quality Act, which requires the involvement of the public in an environmental review of projects of significant environmental effect.

Californians for Alternatives to Toxics
315 P Street, Eureka CA 95570
707.445.5100 <http://www.alternatives2toxics.org/>

February 2008