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Frequently Asked Questions about *Ludwigia* and West Nile Virus

What is the issue? Why is *Ludwigia* a problem? The mosquito-borne West Nile virus (WNV) arrived in Sonoma County in 2004, focusing attention on areas of the Laguna where invasive Uruguayan Water Primrose *Ludwigia hexapetala*, has inhibited mosquito control. The plant has taken over extensive areas of the Laguna, creating dense mats covering the water surface and choking the water column. Mosquito fish (*Gambusia*) which work well to control mosquitoes in the rest of the Laguna, have been ineffective in *Ludwigia* areas. Dense *Ludwigia* growth also obstructs the application of mosquito larvacide pellets, the next most effective and environmentally friendly option. Mosquito numbers in these areas have been recorded at more than 100 times higher than in open-water areas. WNV is a potentially serious illness in humans, is deadly to horses, and has caused wide-spread mortality to birds. There was one horse death in South West Santa Rosa due to WNV in the summer of 2004. WNV does not replicate in humans, so it does not spread from person to person like influenza viruses. However, health officials recommend that residents take the risk seriously, especially if they are over 50 years old and live in an area where WNV transmission is occurring. This means that in Sonoma County, mosquito control operators need to be able to treat the areas now covered by *Ludwigia*.

People who are concerned about the environmental integrity of the Laguna should be very concerned about *Ludwigia*'s other environmental effects. *Ludwigia* has spread very rapidly in our watershed over the past 10 years. In areas where it has taken hold, it has almost completely smothered native wetland plants. Summertime dissolved oxygen levels in *Ludwigia* areas are so low that many fish species cannot survive. Open-water areas favored by waterfowl are choked with this weed, greatly reducing their habitat value. Waterways are obstructed by the accumulated perennial biomass, which may also trap sediment and debris, contributing to ongoing flood-control issues. Biomass doubles in 15-20 days in slow-moving waters, and it is estimated that there is now more than 10,000 tons (20 million pounds) of accumulated *Ludwigia* biomass.

Where are the problem areas? The areas under discussion are flood control channels owned by the Sonoma County Water Agency in the Southwest Santa Rosa/Rohnert Park/Cotati area, and property owned by the California Department of Fish and Game between Occidental and Guerneville Roads: a total of approximately 150 acres. Both areas have such dense *Ludwigia* growth that mosquito control officials can not effectively apply mosquito controls. A map showing these areas is available on our website:
<http://www.lagunadesantarosa.org/RMP/Ludwigia/default.htm>

Ludwigia occurs in smaller patches throughout the Laguna, as well as in the Russian River. We are monitoring the size and spread of these patches. The USDA Agricultural Research Service will do a trial fly-over of the Laguna and parts of the Russian River in June to evaluate the effectiveness of multi-spectral imagery for finding and tracking *Ludwigia*. *Ludwigia* is an emerging problem throughout the western states, and the USDA-ARS hopes to use the information they gain from studying *Ludwigia* in the Laguna to inform *Ludwigia* management throughout the region.

What is causing the *Ludwigia* explosion in the Laguna? There are many factors contributing to *Ludwigia*'s growth and spread; most of them relating to the overall degradation of the Laguna ecosystem: loss of riparian forests, excess nutrients, hydrological changes and alterations, and accumulated sediments all make a contribution. Species invasions are opportunistic. If a plant or animal is introduced intentionally or by accident, and conditions are right, it can spread at great speed. West Nile virus (an invasive species), spread across the North American continent in 5 years.

Ludwigia grows best in shallow, sunny, sediment and nutrient-rich wetlands. We do not yet understand which of these factors is most important or how they interact. The Laguna Foundation, the *Ludwigia* Task Force and research partners at Sonoma State University and the USDA have initiated a large multi-pronged research program to study the ecological triggers that stimulate *Ludwigia* growth. With this knowledge, we can identify which specific steps should best be taken to increase the Laguna's resilience to species invasions. This is akin to helping strengthen the Laguna's immune system. Until then, unless interim steps are taken to curb the plant's invasion, *Ludwigia* will radically reduce biodiversity of plants and animals in the Laguna, and threaten public health and wildlife with West Nile virus. The Laguna Foundation, as well as local agencies and NGOs are also moving forward with a variety of riparian restoration projects.

Where did the *Ludwigia* Management Plan strategy come from? The *Ludwigia* Management Plan was developed in a consensus process by the Sonoma County *Ludwigia* Task Force, with input from weed-management professionals across the state, as well as local environmental organizations. Task Force is an informal advisory body convened by the Laguna Foundation whose members include experts in pesticide use (including Rohnert Park Mayor Jake MacKenzie, a former EPA pesticide regulator with a doctorate in aquatic botany), water quality, public health, mosquito control, fisheries biology, invasive plant ecology, flood control and channel maintenance, and representatives from all public agencies with jurisdiction in weed control matters (see Task Force letter for list). The Laguna Foundation is coordinating the *Ludwigia* effort at the request of the Task Force. The core elements of the Management Plan were unanimously approved by all members of the Task Force in October of 2004 (see Task Force letter).

What is the *Ludwigia* Management Plan? The current draft of the *Ludwigia* Management Plan is available at (<http://www.lagunadesantarosa.org/RMP/Ludwigia/default.htm>). This is a working document that summarizes our current knowledge of *Ludwigia* and the development of short and long-term management strategies. The plan was drafted by Dr. Anna Sears and Lily Verdone on behalf of the Task Force. Dr. Sears is a population biologist and National Science Foundation fellow, who received a doctorate from UC Davis for her research on food web ecology, and the ways that biodiversity is maintained in plant communities. Lily Verdone is a Master's candidate at Sonoma State University, who's research focuses on the ecology of *Ludwigia* in the Laguna, and how it responds to nutrients.

What are the elements of the *Ludwigia* Management Plan? Specific details are given in the *Ludwigia* Management Plan (<http://www.lagunadesantarosa.org/RMP/Ludwigia/default.htm>). The central elements are as follows.

Interim plan:

2005: Survey ecological community at field sites. Use GPS to map extent of *Ludwigia* prior to treatments. Beginning in July (to avoid disturbing salmonids) apply glyphosate herbicide, formulated for aquatic use. After approximately 2 weeks, remove biomass using mechanical harvesters. Compost biomass out of the annual floodplain. Monitor water quality impacts throughout treatment process.

2006, 2007: Work with staff from the Regional Water Quality Control Board to evaluate results of previous-year's water quality monitoring, and revise control plans based on this assessment as well as on new information that becomes available on control alternatives. Survey ecological community at field sites and use GPS to map extent of *Ludwigia* each spring, prior to treatments. Apply herbicides in July to remaining patches, and remove biomass as needed. Monitor water quality before and after treatments.

2008, 2009: Survey ecological community at field sites, map and monitor recurrence of *Ludwigia*.

Long-term plan:

Use science-based ecological research to determine the most effective long-term control strategy for *Ludwigia*. This research is already under way, and is expanding rapidly in scope as more research partners become involved. Important elements include evaluating *Ludwigia*'s rate of spread and modes of dispersal, response to nutrients, response to water-level changes, and its interactions with the native plant and insect community. While this research proceeds, the Laguna Foundation, as well as other local agencies and NGOs are proceeding with plans to enhance the basic environmental health of the Laguna, restoring riparian cover, and finding ways to decrease sediment and nutrient inputs.

Why is the use of herbicides included in the short term plan? The decision to recommend herbicide applications in the Laguna was arrived at with careful deliberation after discussing and initiating research on a variety of alternative methods over the course of more than 18 months. All members of the *Ludwigia* Task Force agreed with this conclusion. The reasons for this decision are spelled out in detail the *Ludwigia* Management Plan. Mechanical removal alone can exacerbate the problem, as the plant regenerates from small fragments of root or stem which float downstream. We estimate that more than 20 tons of *Ludwigia* will need to be removed from the worst-infested areas. Glyphosate, the herbicide being considered in this plan, has low toxicity—and will be used with surfactants considered safe for aquatic use. The maximum amount of herbicides that would be used to treat *Ludwigia* is much less than 1% of the combined agricultural and public annual use in Sonoma County.

Will there be aerial spraying of herbicides? No. Aerial spraying is not being considered for this effort. However, without controlling *Ludwigia* at these sites, it is likely that the Marin/Sonoma Mosquito and Vector Control District would be forced to perform aerial spraying of pesticides to reduce adult populations of mosquito species which transmit West Nile Virus. The pesticides used for adult mosquito control are known to be more toxic (especially to fish and amphibians) than are the herbicides proposed for use in the interim *Ludwigia* control program. Herbicides will be applied to *Ludwigia* from land-based equipment, such as boats or ARGOS.

Is my well water at risk from herbicide contamination? The risk of well-water contamination is very low. Glyphosate has a high affinity for soil particles, and is broken down by microbes in the soil. Between 1986 and 2003 the California Department of Pesticide Regulation (DPR) tested for glyphosate contamination in 3891 wells, in 51 counties. Of these, there was one instance of glyphosate present at 20 parts per billion (ppb), but follow-up sampling did not confirm detection. This level is less than 3% of what is allowed in drinking water (700 ppb).

Why not use *Ludwigia* for bioremediation? Isn't it trapping nutrients?

Ludwigia is taking nutrients out of the water, but unless it is harvested it does not remove the nutrients from the system. Each winter as the leafy green parts decay, these nutrients are returned to the water column. Harvesting *Ludwigia* without first killing it with herbicides risks spreading reproducing fragments through the system. Also, if the roots are not killed, *Ludwigia* will quickly re-sprout. Wildlife and fisheries biologists, as well as representatives from the Regional Water Quality Control Board, believe that repeated harvesting *Ludwigia* from the Laguna would cause much more environmental damage than the program proposed by the Task Force. While it might seem that *Ludwigia* would work well for bioremediation in a constructed wetland for treating waste water, this plant appears to be spread by birds, and could easily escape into wildlands. There is a special alert listed for *Ludwigia* in Europe and the Mediterranean, warning countries to be on the lookout for this invasive species, so that control measures can be put in place before the infestation becomes widespread.

What happens after the interim *Ludwigia* control program? Additional planning and research money is earmarked for investigating long-term no-spray control strategies, which include a range of alternatives from extensive riparian restoration and improving water quality, to water-level management, biological control organisms and goat grazing. The Laguna Foundation is actively developing research partnerships to assist in this effort. Researchers from the USDA Agricultural Research Service (ARS) will be initiating experiments this year to evaluate *Ludwigia's* response to water-level changes, and to better understand *Ludwigia's* ecological interactions with other species. Lily Verdone is continuing her research on the relationship between *Ludwigia* growth and nutrient levels in the water. She will also continue her experiments with tarping and goat grazing, which she began last year. In June, the ARS will do a test fly-over of the Laguna and parts of the Russian River, to evaluate whether *Ludwigia* patches can be picked out using multispectral imagery. This will be an important tool for evaluating rate of spread in the watershed.

What is the process? Following the recommendation of the Task Force, the California Department of Fish and Game and the Sonoma County Water Agency are pursuing permits from the Regional Water Quality Control Board to control *Ludwigia* in the described project areas. The permit applications are for coverage under a statewide National Pollutant Discharge Elimination System (NPDES) permit that has already been issued for use of the proposed herbicides for invasive aquatic weed removal in the State of California. The Laguna Foundation will contract with an experienced, licensed pest control operator to do this work, and will closely monitor control activities to ensure that they are carried out with the greatest possible environmental sensitivity. Throughout the development of the plan, the *Ludwigia* Task Force worked to include suggestions from the environmental community. This input has led to an increased emphasis on long-term solutions, research and restoration, as well as increased monitoring and the selection of environmentally-appropriate surfactants for herbicide applications.