

Controlling Arundo in Your Watershed – A Guide for Organizations

This Guide contains information to help organizations establish and maintain cooperative efforts to eliminate Arundo from streams in their watershed. It should be useful for non-profits, government agencies, Resource Conservation Districts (RCDs), eradication or restoration companies working with communities, educational programs such as Adopt-a-Watershed, and others. It will also help groups working to control and eliminate other non-native invasive species from streams in their area. This Guide is intended to be used as a companion to "Arundo: A Landowner Handbook."

A. Working with Landowners

It takes more than rounding up a group of willing volunteers to organize an Arundo eradication effort. "Arundo-bashing" takes place in the context of a diverse watershed community, and it often occurs on private property. Therefore, a successful eradication program requires sensitivity to landowners' concerns, and effective public outreach.

If you contact landowners personally and establish trust, your eradication efforts will be more successful. Listen to, and sincerely acknowledge, their interests. It is best to meet one-on-one.

When you take the time to meet and talk with people, the conversations can be time-consuming and occasionally confrontational. Removing established plants may meet resistance from residents based on concerns such as erosion control, privacy, attachment to what is familiar, fear of change, and fear of regulatory consequences if any sensitive species or habitats are found onsite. The challenge is to address all of these concerns.

Building working relationships with watershed stakeholders pays off handsomely in the long run for two reasons. First, Arundo is only one of numerous issues affecting watershed health. All of these issues require the cooperation and participation of the watershed's landowners. Their essential role makes all the effort it takes to build these relationships worthwhile. Second, it is rewarding to discover new partners, friends, and neighbors. Even though the bulk of Arundo work is in preparing for actual weed removal, the work wouldn't be half as interesting if it was just cutting cane.

B. Eradication Planning

General Strategy

It follows from the ecology of Arundo that the direction of its spread is downstream. Therefore, work in a downstream direction, starting with the upper parts of the watershed. Sites in the upper watershed will usually have smaller infestations. Once the upper water-

Use this Guide Together with the Landowner Handbook. This Guide was created as an addendum to "Arundo: A Landowner Handbook." It expands on topics that are relevant to organizations and not necessarily to individual landowners. Please read the Landowner Handbook before the Organizational Guide, especially about the following topics: Arundo's impacts on watersheds, eradication methods, permitting issues, and requirements for herbicide use.



Illustration by Sally Davis

shed is Arundo-free, eradication sites further downstream won't be in danger of becoming re-infested. To help fund eradication of upstream propagule sources, consider requesting assistance from agencies whose work involves downstream areas. For example, a downstream Flood Control District may contribute money, labor, or herbicide to remove upstream sources of Arundo. Generally, it is best not to work on a downstream site unless someone is also addressing upstream propagule sources. However, if a downstream site is a small pioneer clump in a relatively uninfested reach, then it might be worth removing it.

Work with what you have. Focus at first where you have permission and can be successful. Early successes, however small, will raise awareness, boost your confidence, and help sell future efforts. Don't start by going after huge infestations with volunteers. Use small projects to gauge how much area your team can tackle without losing their enthusiasm. Simultaneously, map the extent of larger infestations downstream, and pursue permission, funding, and labor to tackle them.

Neighborhoods of streamside landowners may be motivated to work together, each contributing what they can, because Arundo problems go beyond an individual site. Large infestations of Arundo can constrict stream channels and re-route streams. These changes can create erosion and sedimentation problems downstream and across from the infestation.

Refer to the table *Who to Contact* in *A Landowner Handbook* to ensure you comply with any relevant permits. Consider any sensitive species in your streams and what time of year they will be least affected by eradication work. Particularly if your organization is an agency or planning a large eradication project, check very carefully that you have notified and satisfied all relevant regulatory entities before proceeding.

Develop an Eradication Plan

A regional or watershed-scale eradication effort requires an Eradication Plan. The Plan will help identify the scope of the effort, personnel and material needs, a time frame, and costs. The first step in developing an Eradication Plan is to pick a geographic area that seems reasonable, relative to the resources of your organization. If the project area you are concerned about seems too large, break it down into regions and schedule the effort in phases corresponding to the regions. Phase One should begin upstream or at the headwaters of the watershed. Phase Two would be the next area downstream, etc.

The first task in each Phase is to assemble a database of streamside landowners in that area, including their addresses and, if possible, phone numbers. The database will allow you to contact streamside landowners to get permission to survey for Arundo's presence and later remove it. Creating the database takes a significant investment of time. In most cases, it means spending days at the county Assessor's office to research the owner's name and address on every creekside parcel of land. Your landowner database will come in handy with other riparian-related issues beyond eradication of Arundo.

The next task is to survey the location and size of Arundo infestations in the area of each Phase. Inquire for existing data from other groups and resource agencies, particularly agencies in control of waterways such as flood control and water agencies, and the Department of Water Resources. Flood maps, available from the county, are useful as a

base map because they focus on low-lying areas adjacent to streams where Arundo is commonly found. The survey can be done by volunteers, Boy Scouts or Girl Scouts, or paid professionals. A sample form for survey instructions and data sheet, "Arundo Mapping Procedures," is included in the Appendix. These Procedures include data on stream health; simplify them as needed. Keep in mind that stream systems, and Arundo locations, change over time; therefore, keep the mapping procedure simple.

It is difficult to map Arundo without trespassing because property lines often run down the center of creeks. In some streams, Arundo mapping can be done from a boat or kayak using landmarks or a Global Positioning System (GPS) device. Survey what you can from access-points like roads, bridges, and railroads. Beyond that, you will need to contact the landowners and request permission to come onto their land (see Contacting Landowners and Getting Permission and Access). Boy Scouts or Girl Scouts, or other youth groups are good survey volunteers because they are not threatening.

The landowner and survey data can be transferred to a regional or watershed map for reference and further evaluation. If you have access to a Geographic Information System (GIS), the data can be entered into a computerized mapping database. The advantage of a GIS is the ability to enter property lines and parcel information into the database as well. A GIS can produce an updatable map that has every infestation located and whose property it is on. From a GIS or other database, you can generate mailing lists for specific reaches of stream.

After Arundo locations are identified throughout the project area, the total number of infestations and their net size can be determined. An estimate of time and materials needed can be estimated from these totals. An eradication schedule can be developed and implemented. Requests for funding will have a solid foundation and stand a better chance of success if these pre-proposal measures are completed.

Once the work load is clearly understood, several tasks remain. Project managers can be selected and volunteers trained to do the actual eradication. Eradication takes place next, followed by monitoring for re-sprouts, follow-up treatments, and finally revegetation, if necessary. The long follow-up period needed after eradication is a weak link in many eradication programs. Organizations can greatly improve the success of eradication work done by landowners, by taking on some of the lengthy post-eradication tasks.

You may wish to treat other invasive riparian weeds at the same time as Arundo, if you have positively identified them and are confident of your eradication methods.

C. Contacting Landowners

Personally contacting landowners is necessary to get permission to access their property and remove Arundo. In some cases, it is the only way to find out if Arundo is on their property.

Clear communication is the path to establishing a good first impression. Identify yourself, your organization and then say, "We're working to get rid of Arundo, the giant reed that is taking over our creek." Ask the property owner, "Are you aware of this plant and have you seen any along the creek?" If the owner is unaware of Arundo, offer to come over and

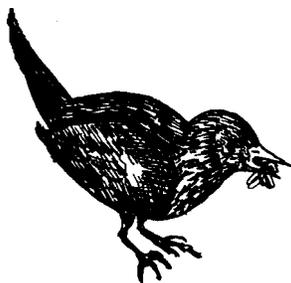
show him a brochure with a picture. If he declines, ask if it would be alright to mail it to him. If this fails, wait a couple of months and call back. Most people warm up to a good idea eventually. Some property owners may not return phone calls or simply refuse to cooperate. In these cases, simply move on to the next downstream neighbor and come back when there is more neighborhood support or have an interested neighbor contact him directly.

If the owner is curious, educate him about the plant and its negative impacts. Describe how this plant is affecting the vegetation that provides the habitat and shade that is needed for fish to survive. Let him know about the community-wide effort to eliminate Arundo from your watershed. Explain how you are working your way downstream property by property, removing Arundo clumps so it doesn't continue to spread downstream.

It is important to present your project as a community effort and show every effort to accommodate the landowner's concerns. Be brief and business-like. Explain your objective, assure the owner that your intrusion will be brief, and request permission to access the property for eradication purposes only. Promise to perform the work only when it is convenient, to call before arriving, and to bring only the needed number of people onto the site.

If the property owner is receptive to a visit, offer to survey the creek and help identify Arundo or other invasive pest plants. Walk the property and get to know the owner. Questions about your organization, about Arundo, eradication techniques, and restoration will come up. Be prepared to answer. If objections surface, express your understanding and give an example of a similar concern and how it was solved. Even if no Arundo is found, you may have discovered a potential partner or volunteer. If the landowner seems amenable to helping with Arundo removal, ask for information or assistance with contacting neighboring property owners and obtaining their cooperation.

Supporting documentation can reinforce your message. Show newspaper articles if you have them, use pre-printed outreach materials, mention the names of neighbors cooperating with your effort. If you have mapped infestations in the watershed, show the map to the owners. Aerial photos are particularly effective, because people like to see their land in the context of its surroundings. Use letters of recommendation from local offices of the Department of Fish and Game or other agencies, university professors, or other accepted authority figures. You can refer to the Presidential Executive Order mandating government action on invasive species (text at www.worldnetdaily.com/bluesky_govdocs/eos/eo13112.html).



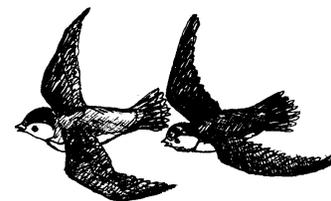
D. Addressing Landowner Concerns

Getting a private property owner to let you come on his land to cut down part of his landscaping can be a real challenge. There are many valid concerns about Arundo eradication and plenty of reasons to refuse you access. The way to get permission is to make the process as simple, non-threatening and convenient as possible. By knowing what the typical concerns are, you can usually avoid objections and address concerns as they arise. Impressing the owner with the aggressive nature of the plant and the benefit of cooperating with a community effort should be enough to get him on board. If the owner

still balks, move on to the next clump downstream, continuing until eradication is complete in that section of the watershed. At that point, with the weight of public opinion clearly on the side of Arundo removal, the owner will probably cooperate.

The property owner can also be directed to seek streambank and water quality protection advice from a number of public agencies (see the Who to Contact table in *A Landowner Handbook*). California Department of Fish and Game biologists, Resource Conservation District engineers, and other agency representatives will usually meet onsite and give specific advice about mitigating any damage that could occur when eradicating Arundo.

Typical concerns of landowners have been addressed in *A Landowner Handbook* in the form of questions and answers. Common concerns are discussed below; they include privacy, erosion, liability, regulatory problems, property damage, impacts to natural resources, and personal injury.



Privacy Concerns

Like bamboo, Arundo can make an excellent screen, like a tall fence. Unfortunately, this screen often escapes and spreads into the creek. It is difficult to immediately mitigate this concern. Planting other species or building a fence will only get in the way of eradication efforts. It takes several follow-up treatments to eradicate Arundo, requiring at least one year to ensure complete removal. A replacement planting of a screen of native plants should take place only after assured eradication. In case the owner is set on having a screen, you could offer to replant later. If this doesn't work then explore a fencing option. Landowners who wish to minimize the presence of strangers on their land can control resprouts and re-infestations themselves after initial eradication.

Erosion Concerns

Erosion is a common concern of creekside landowners. Many property owners have taken extensive erosion control measures to protect their property, including planting Arundo on creekbanks. Arundo eradication meets resistance because some information sources are still promoting Arundo as a suitable plant for erosion control. However, this plant has proven to be a poor choice due to its shallow roots and its tendency to break loose in large flow-clogging mats. (See *Problems for the Watershed* in *A Landowner Handbook*.) With some landowners it may be futile to argue whether Arundo is appropriate for erosion control; in these situations, emphasize the threat to the watershed posed by Arundo. With other landowners, you can educate them about Arundo's inadequacy for erosion control, and communicate that moderate erosion is a natural stream phenomenon. Once the landowner understands the problems associated with Arundo, then you can discuss erosion control measures that can be installed at the time of Arundo eradication. Willow, alder, and cottonwood can all be planted as live stakes directly into the dead Arundo rootmass. This method is ideal because of the minimal soil and root disturbance. These species require constant soil moisture, so they are only appropriate near the waterline.

Erosion Control Choices. There are many approaches to solving erosion problems and stabilizing streambanks. Refer to the Revegetation section and the Who to Contact table in *A Landowner Handbook* for general information. Each situation calls for site-specific analysis to determine the appropriate repair. It is wise to plan carefully and get several opinions before moving forward. Keep in mind that stream systems are dynamic, and there is a risk of bank collapse even with the best techniques.

In many cases, it is best to do nothing and allow nature to take its course. If property is threatened and intervention is necessary, consider "softer," less intrusive means of bank stabilization, such as staking live cuttings of certain riparian species. The success of live staking depends on the current stability of the creekbank. If the Arundo root mass is already loosening from the bank, it may break away in a high water event taking your plantings with it and leaving the bank exposed. You can stake down jute netting over the root mass if the canes have already been cut. If the canes are still intact, they can be tied into a bundle and anchored to prevent the root mass from washing away.

Bio-engineering techniques have been developed to avoid "hard" solutions like riprap (stacked boulder) or gabion (rock-filled wire basket) retaining walls. Alternatives using a combination of materials can mitigate erosion and preserve a natural setting. One technique is to use bundled, live willow cuttings planted in soil retained with geo-textile fabric. Bio-engineered approaches can be less expensive and more practical for the property owner to accomplish.

In particularly unstable areas, a consultation with a streambank repair specialist is needed and an engineered solution may be required.

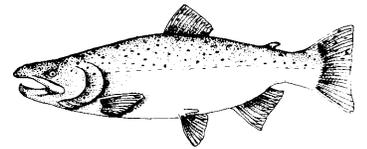
Impacts to Natural Resources

Property owners may be justifiably concerned about the impacts of sediment deposited into the stream during or after Arundo eradication work. If techniques are used improperly, sloppy eradication work can indeed cause these problems. However, these impacts can be avoided by using appropriate removal techniques at the right time of year. Follow *A Landowner Handbook* carefully.

Other people worry that herbicide residues will contaminate stream water and kill fish. If the owner is opposed to the use of herbicides, you can present several compelling arguments. Remember that the use of chemicals is a highly charged issue; don't get into an argument that will alienate a potential partner. You can compare the low risk of damage to the environment by careful herbicide application with the serious ongoing damage to the diversity and function of the aquatic and riparian ecosystem by Arundo. The evidence is clear that Arundo is too stubborn to be killed by mechanical means without a great deal of effort over many years. Painting cut stumps with herbicide is the technique of choice with landowners worried about herbicide impacts. If after your conversations the landowner still refuses to use herbicide, you can proceed using a mechanical method, preferably with the landowner's firm commitment to conduct follow-up patrols and treatment.

Property Damage

Eradication of Arundo on the streambank frequently raises concerns about soil erosion, bank loss and possible damage to structures, not just onsite but also on other properties. In most cases, these problems are consequences of improper eradication methods and poor timing. Refer to the discussion in *A Landowner Handbook* on the appropriate use of the various methods. In a few cases, removing very large Arundo colonies may cause a gradual shift in the stream's flow-path that could damage off-site properties. This is because the thicket of canes forms an artificial streambank that affects where the water flows. Once the barrier of canes is removed, the water will establish new pathways that may collide with vulnerable streambanks. Large eradication projects should obtain the support of property owners downstream before proceeding with eradication.



Regulatory Problems

Some landowners worry that if a protected species or habitat is discovered during eradication planning or work, their land management activities may be restricted and they may face fines. Resource Conservation Districts (RCDs) are local, non-regulatory agencies designed to serve as a liaison between landowners and regulatory agencies. Landowners concerned about environmental regulations or activists are generally comfortable working with the RCD. Obtaining all relevant permits protects landowners against the small possibility of a natural resources agency or another landowner filing a suit for degradation of the downstream environment.

Personal Injury

Organizations can avoid liability concerns by having their own insurance. (See *Working with Volunteers*.) The property owner may also have homeowner insurance that covers casual labor. Policies vary and may be limited to brief periods for paid workers. Another option for the property owner is to hire a private contractor to do the eradication work. Contractors who specialize in weed removal will have their own insurance or a bond. The high cost for hired eradication may make the owner reconsider the volunteer option.

E. Negotiating an Eradication Agreement

In many watersheds, most streamside properties are privately owned. Getting permission to enter is a legal requirement. Property owners have no legal obligation to grant access. Property owners will grant access and permission to remove Arundo when they understand the problem and trust the individual or organization doing the work. Education may be the first step to understanding the issue, but establishing trust is the first step to understanding each other.

Make sure you and the owner share the same idea of what the eradication effort will entail in terms of time on the site, number of people, disposal strategies, herbicide use, follow-up treatments, passive versus active revegetation. Talk with the landowner about what route is best for access to the stream. Encourage the landowner to be part of the

eradication crew. Landowners can provide an enormous service to the health of their watershed by taking responsibility for conducting follow-up treatments and preventing future Arundo invasions on their land. Landowners who become partners in eradication work by contributing their own labor and resources are more likely to assume these important responsibilities.

Verbal permission is usually enough, but if you feel uncertain about the owner, you may want to get permission in writing. You may want the parties involved to sign an Agreement detailing the particulars of the planned work (see sample *Letter of Agreement in the Appendix, which you are encouraged to modify to suit your circumstances*).

F. Working with Volunteers

Most community organizations and non-profits depend on volunteers for their eradication crews. Members of organizations, property owners, neighbors and referrals from other groups are all potential volunteers. Wherever they come from, they are welcome. Steady volunteers are rare and are greatly appreciated. They make up the backbone of most community organizations. Businesses and agencies can also benefit from local volunteer support for their work.

Directing volunteers is far different from managing employees. The volunteer is keenly aware of the distinction between paid work and volunteered time and will not tolerate poor leadership, long hours, boredom, or unnecessary hardship. For example, it is important that volunteers know the schedule for the day and that you stick to it. If you need to deviate, ask permission. Trust is essential to maintaining any volunteer program.

Safety is always an issue when working in a large group. Keep your volunteers safe! First and foremost, make sure volunteers are covered by your insurance policy. Have everyone sign in before starting work. Emphasize the need to be aware of people working around them and to take their time. Insist that they take responsibility for their safety and their actions. When bashing Arundo volunteer-style, people wield sharp implements and long spears of recently cut Arundo. Beware of the occasional rattlesnake or yellow jackets' nest in the ground. Remember, no sharp pointy stumps when cutting those canes!

**Remember:
No Sharp, Pointy Stumps!**

When leading a volunteer group, have clearly defined tasks. Make sure people are working together. Keep it light and fun. Hard work is fine as long as it is not pushed. It helps to take frequent breaks and provide beverages and snacks.

Take the time to describe the larger goals and the process to volunteers. Explain why Arundo is a threat to native plants, animals and the creek. The more they understand, the more they will care and get involved.

Plan half-day workdays. Mornings from 9 to 1 work well. It's cooler in the morning. Volunteers generally don't show up any earlier in the morning and will often disappear after lunch. Going out to lunch afterward can be as rewarding as the morning work. Breaking bread with fellow workers is a bonding experience. Building volunteer relationships helps create a sense of community, and community relationships keep these projects going.

G. Working with Other Stake-Holders: Agencies, Companies, and Non-Profits

Aim to build long-term relationships with other players in the watershed. Arundo conveniently serves as an obvious common threat for diverse interests to focus on.

Agencies and businesses may donate time for consultation, disposal, project funding, and/or revegetation advice, especially if you publicize their involvement in your newsletter or at public events.

If you work with the California Conservation Corps, inmate crews, or other hired crews, keep a few pointers in mind to greatly improve the experience for all parties. Expressing respect for their toil, and demonstrating the appreciation of the landowner and organizer will go a long way. Consider providing food and drinks for your hard-working crew. Thank them personally. If possible, provide a portable latrine near the work site.

Non-profit groups may know their watershed intimately and help greatly with mapping Arundo sites. For businesses and agencies, working from the beginning with community members and organizations can greatly ease the process of contacting landowners and getting permission to eradicate Arundo. Keep in mind that non-profits commonly run on a limited budget. While they are usually highly dedicated, their staff may need reimbursement for time and travel, and their volunteers may have limited time.

H. More on Eradication Techniques

Large Scale Eradication Techniques

Large infestations that cover acres or miles of land require more mechanized, labor-saving eradication methods. The methods described below are not recommended for the homeowner or the small community organization. Government agencies and private contractors use these methods to deal with large expanses of Arundo. Methods that would be considered invasive or drastic are employed because of the enormous scale of the eradication and the repercussions of non-treatment. In addition, these vast stands of Arundo have generally choked out native vegetation, so broad-scale herbicide application or excavation are considered reasonable tactics.

Root Excavation

Some contractors have used backhoes or excavators to dig up Arundo roots. Efforts on Camp Pendleton (San Diego County) in upland riparian areas using this method had mixed results. The contractor reported a high kill rate and reasonable costs. Non-native understory plants dominated the site afterwards because of the soil disturbance. The method was limited to areas with heavy equipment access and where few native trees and shrubs were mixed in with the Arundo. Spraying resprouts was required after rhizome removal since there were some rhizome pieces missed by the excavators.



Other efforts on record met with poor results due to lack of completion. Some roots had been buried under a silt deposit up to several feet deep, too deep to excavate. The cost, soil disturbance, and access problems make it an unpopular choice.

Flail Mowing

Some companies mount large flail mowers on tractors to mow and grind up the stalks into mulch that cannot resprout. Flail mowers are best suited for large pure stands with easy access and low risk of erosion. For very large stands, the "Cut, Resprout, and Spray" method using flail mowers operated by experienced contractors is a cost-effective means of eradicating Arundo. Costs vary greatly depending on the terrain, the mix of native species, and access. The labor and cost of cane disposal are eliminated since the plants are chipped as they are cut. (Photo courtesy of Pestmaster Services, Inc.)

Herbicide Application

Requirements for Applying Herbicide. Landowners don't need a pesticide applicator's license to make herbicide applications on their own land, so if the owner is interested, it's much easier on small jobs to have the owner do the application. There are other requirements for people applying herbicides on lands they don't own or otherwise control. Refer to A Landowner Handbook for more information or contact your county Agricultural Commissioner. You can also read about requirements from the California Department of Pesticide Regulation at www.cdpr.ca.gov/docs/whs/pdf/hs1742.pdf.

Commercial pesticide applicators have expertise and equipment appropriate for large infestations. In some cases, spraying from helicopters has been done. All-terrain vehicles equipped with 15-20 gallon sprayers are the preferred approach where the streambed is not so rocky as to prevent access. Three to five gallon backpack sprayers are preferred where the vegetation is too dense or the landscape too rugged for vehicles to be effective. Rodeo® (the form of glyphosate approved for aquatic use) is almost exclusively used on large scale projects due to the high volume of material being applied near streams and the increased potential for runoff and non-target spray.

Revegetation

In *A Landowner Handbook*, a distinction was made between passive revegetation which occurs naturally, and active revegetation, in which human effort is added to natural recovery processes. When thinking about how well passive revegetation can work on a particular site, consider the likely sources of plant material. Are there onsite or nearby upstream sources for native shrub seeds or willow sprouts? Does the site have a lot of disturbed, unvegetated, sunny ground that could act as a magnet for weedy grasses? Attempts to revegetate riparian species at sites that have both native plant sources and natural flood regimes simply waste time and resources. On the other hand, if a landowner strongly desires a privacy screen or is greatly worried about bank erosion after Arundo removal, active revegetation may be in order. Also, natives on higher terraces above the stream may need active revegetation.



When planning active revegetation or restoration, remember that the people who first introduced Arundo to streams in California thought they were doing the right thing. It is best to err on the side of caution and remember that your site affects everything downstream. These caveats are not meant to discourage you from proceeding with restoration, which can be an immensely satisfying activity that greatly benefits the watershed.

Choose the simplest project that will still satisfy your objectives. Use only locally native plants. Seek advice from experienced people before you act. Be aware that people knowledgeable about native plants or stream dynamics are not necessarily knowledgeable about restoration or revegetation, and vice versa.

I. Prevention and Public Outreach

Arundo spreads aggressively on its own, and it is even more successful at spreading when people unwittingly help. The Arundo invasion is not simply a biological problem; it is a social one. Here are a few points about addressing the human aspects of Arundo invasion.

Fundamental changes are needed to prevent new introductions of Arundo. Amazingly, nurseries sell Arundo and other invasive weeds without warning labels. For a website listing some of these invasives see <http://www.taunton.com/fg/features/plants/invasive/2.htm>. Any work you can do with local nurseries and landscapers to prevent more planting of Arundo will be highly beneficial. Public land management and agricultural agencies, plus groups such as Team Arundo del Norte (TAdN), the California Exotic Pest Plant Council (CalEPPC), and the California Interagency Noxious Weed Coordinating Committee (CINWCC), are working at the legislative level to prevent casual sale of Arundo plants. You can get involved in these efforts.

Use multiple approaches to spread the word about the threat Arundo poses. Other outreach materials are available, including the brochure and video "*Arundo: Streamside Invader*" and "*Arundo: A Landowner Handbook*." Publicize your efforts in local newspaper articles. Many newspapers, especially small local ones, are grateful for community interest stories. Call the paper, ask for the news desk, be polite, and offer your story. Post reports on your work on local or regional websites about watershed management,

ecological restoration, fisheries work, etc. Take pictures of your projects to graphically show the cooperation, effectiveness, and camaraderie of eradication work. Pictures of native plant seedlings coming up where an Arundo thicket once grew are effective.

Don't let your spoken or written words about Arundo eradication become unbalanced. Although it's fun to have an enemy like Arundo to bash whole-heartedly, it is probably not helpful to paint Arundo as an evil plant and your eradication efforts as a holy war. Some people like Arundo as a landscape plant. It is a beneficial plant in some respects, and if managed properly, its impacts on wildland areas can be minimized.

You can use the issue of Arundo invasion to raise awareness about other watershed issues, particularly the value of riparian and aquatic habitats, and other invasive riparian species in your area, such as ailanthus, tamarisk, and acacia.

J. More About the Identification and Biology of Arundo

How to Tell Arundo from Similar Species

- **Bamboo.** Many species of bamboo are planted for ornament, erosion control, or privacy. It grows well near watercourses. At least in our area, bamboo is not nearly as invasive as Arundo, because it does not propagate downstream. Bamboo leaves grow on small branches called petioles. By contrast, Arundo's broad leaves have no petiole; instead, they extend all the way to the stem, where they have a broad base that wraps around the stem. Bamboo leaves are generally smaller than Arundo's and often shiny.



Arundo



Bamboo



Common Reed

- **Common Reed.** *Phragmites communis* or *P. australis* is less than 12 feet tall and has thinner stems and flat leaves, unlike Arundo's V-shaped leaves.

Site Preferences of Arundo

- Arundo favors low-gradient riparian areas (<2% grade).
- It is usually associated with rivers that have been physically disturbed or dammed, but it also can colonize within healthy native stands of cottonwoods, willows, and other riparian species, even in full shade.

- It establishes primarily in streamside sites, but can then expand beyond the margins of riparian vegetation.
- Arundo tolerates a very broad spectrum of soil textures, from gravels to heavy clay. It grows best in well drained soil with ample moisture. It can tolerate semi-saline soils at margins of brackish estuaries.

Current Range of Arundo in Central and Northern California

- Arundo has invaded central California river valleys in San Luis Obispo and Monterey Counties, the San Francisco Bay Area, in the Sacramento and San Joaquin River valleys, and is increasing in the North Coast region.
- It does not appear to tolerate high elevation or inland environments where sustained freezing occurs.
- Most Arundo canes (culms) are unbranched during their first year of growth. Branching occurs with age, when a stem is cut or bent over, or when a node contacts moist soil.



Illustration by Sally Davis

K. Where to Get More Information

It takes work to track down relevant information and keep up with new information. The task is easier if you join interest groups that include local and state agencies, academics, and watershed organizations. Make use of the sources listed in *A Landowner Handbook*. Excellent general information sources are:

- Team Arundo del Norte at www.ceres.ca.gov/tadn or email to team_arundo@ceres.ca.gov. You can also contact these TAdN members: Tom Dudley (UC Berkeley, 510/643-3021, tdudley@socrates.berkeley.edu), Richard Dale (Sonoma Ecology Center, 707/996-9744, sec@vom.com), or Deanne DiPietro (CA Environmental Resources Evaluation System-CERES, 916/653-8614, deanne@ceres.ca.gov).
- CalEPPC (California Exotic Pest Plant Council) at www.igc.apc.org/ceppc/index.html, or 31872 Joshua Dr. #25D, Trabuco Canyon, CA 92679.
- Information Center for the Environment (ICE) at UC Davis, <http://ice.ucdavis.edu>.
- Local office of UC Cooperative Extension Service. See state listings in government pages of the phone book.
- Local Resource Conservation District (RCD). See Natural Resources Conservation Service or Department of Agriculture in federal government pages of the phone book.
- California Interagency Noxious Weed Coordinating Committee (CINWCC). 1220 N St, Room A-357, Sacramento CA 95814. Their excellent newsletter is called Noxious Times. Contact Steve Schoenig at (916) 654-0768 or sschoenig@cdfa.ca.gov.

Eradication

- California Conservation Corps. Administrative office in Sacramento at (916) 341-3100.
- Weed or vegetation management companies (yellow pages under Weed Control Service). Ask detailed questions about their techniques, particularly about how they will protect streamwater and native riparian plants during eradication, and what their policy is concerning follow-up treatments.
- CALWEED database of weed removal projects and control methods. A project of CINWCC. At endeavor.des.ucdavis.edu/weeds/.
- California Department of Pesticide Regulation at www.cdpr.ca.gov or (916) 445-4300, for information about requirements for using herbicides.

Revegetation

- Society for Ecological Restoration, California Chapter (SERCAL), at www.sercal.org or SERCAL, 915 L Street, #C-104, Sacramento, CA 95814, (805) 634-9228.
- California Ecological Restoration Projects Inventory. endeavor.des.ucdavis.edu/ceppi.
- Margolin, Malcolm. 1975, revised 1985. *The Earth Manual: How to Work on Wild Land without Taming It*. Heyday Books, Berkeley, CA. Excellent, delightful general book about land restoration and working with children.

Invasive Weeds

- Ken Moore and Tim Hyland. 1998. *A Plague of Plants: Controlling Invasive Plants of Santa Cruz County*. Wildlands Restoration Team, Santa Cruz, CA. Available through www.wildwork.org. Website contains excellent articles about successful volunteer programs in the How To Articles section. (831) 423-2801.
- Dudley, T. and B. Collins. 1995. *Biological invasions in California wetlands: the impacts and control of non-indigenous species in natural areas*. Pacific Institute for Studies in Development, Environment, and Security, Oakland, CA.
- Center for Aquatic and Invasive Plants website (aquat1.ifas.ufl.edu), University of Florida. Incredibly informative and comprehensive.
- Special Issue: Weeds. October 1998 issue of *Fremontia*, a journal of the California Native Plant Society. Vol. 26, no. 4. CNPS, 1722 J St., Ste. 17, Sacramento, CA 95814.
- California Native Plant Society. Excellent links at www.calpoly.edu/~dchippin/exotic.html and www.northcoast.com/~cnps/exotics.html.
- CERES page on invasive species: www.ceres.ca.gov/theme/invasives.html.

- Weed Science Society of America: ext.agn.uiuc.edu/wssa/.
- The Nature Conservancy's weed web page is incweeds.ucdavis.edu.
- Weed Research and Information Center: wric.ucdavis.edu.

L. Credits

This Guide was produced in 1999 for the California Department of Fish and Game by the Sonoma Ecology Center and California State University, Sacramento, Media Services. The text was written by Mark Newhouser, Caitlin Cornwall, and Richard Dale at the Sonoma Ecology Center, and greatly improved by reviews from members of Team Arundo del Norte. Team Arundo del Norte, CA Department of Fish and Game, and the Sonoma Ecology Center are solely responsible for the content of these materials. Second printing made possible by Michael Krebsbach and Nelroy Jackson of Monsanto. Various sections draw from the expertise of Gary Bell, Lois Battuello, Tom Dudley, and Nelroy Jackson. Thanks to Team Arundo del Norte for incubating this project. Team Arundo del Norte is a multi-stakeholder partnership dedicated to the control of Arundo in central and northern California.

Also available by the same group: Arundo: Streamside Invader (a brochure); Arundo: A Landowner Handbook; and Arundo: Streamside Invader (a video). For copies of these materials or to send feedback, see the Team Arundo del Norte website at www.ceres.ca.gov/tadn, email team_arundo@ceres.ca.gov or call Joel Trumbo of the California Department of Fish and Game at (916) 358-2952.

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Margolin, Malcolm. 1975, revised 1985. *The Earth Manual: How To Work on Wild Land Without Taming It*; all rights reserved. Heyday Books, Berkeley, CA. Illustrated by Michael Harney. Pages 3,6,15.

Yates, Steve. 1988. *Adopting a Stream: A Northwest Handbook*; all rights reserved. The Adopt-A-Stream Foundation, USA. Illustrated by Sandra Noel. Pages 4,5,7,9,11.

Arundo Removal at Location(s) _____

Stream Habitat Restoration Project Agreement

I. Purpose

The following agreement details requirements of both the landowner and [Contractor] and related agencies regarding establishment of a stream habitat improvement project on real property controlled by the landowner named below. Said property is located within a 3/4 mile reach of [stream name, specific directions] (see map attached to proposal).

I, _____ hereinafter "Landowner", understand the objectives of the project as proposed in the [stream name] *Arundo donax* Eradication Plan. The project has been described to me by copy of the Plan from [Organization] (attached), [and neighborhood representative [name]]. I support the goals of the project.

II. Access Permission

Landowner hereby grants [Contractor], [agencies], and [Organization(s)] permission to enter onto real property owned by the Landowner to perform pre-project evaluation and to perform the stream habitat restoration work, conduct project inspections, and monitor project for needed maintenance for a 10-year period following project completion. Access shall be limited to those portions of landowner's real property where actual stream restoration work is to be performed and those additional portions of the real property which must be traversed to gain access to the work site. [Landowner] has offered access via their properties for staging, stacking, burning, and other conduct required to successfully eliminate Arundo.

[Terms of private property owner participation could be included in this agreement, for example: Lead property owner agrees to burn all slash by December 1 and accomplish final site clean-up. Lead Property owner agrees to procure specified herbicides as necessary, and perform monthly inspections for three months, eradicating new growth; and to perform annual inspections and eradications as necessary over the ten-year period of this project.]

III. Duration of Notice

The term of this agreement shall be [number] months for work performance, and [number] years for maintenance, inspection, and monitoring purposes from the last date of execution shown below. This is provided that [Contractor] shall give Landowner reasonable actual notice and any necessary arrangements are made prior to each needed access. Reasonable and actual notice may be given by mail, in person, or by telephone from any above named agency or [neighborhood representative].

This agreement can be amended only by prior written agreement of both parties executing this permit.

IV. Liabilities

Reasonable precautions will be exercised by [Contractor] to avoid damage to persons and property.

[Contractor] agrees to indemnify and hold harmless the landowner and agrees to pay for reasonable damages caused by reason of the uses authorized by this permit, except those caused by the gross negligence or intentional conduct of the landowner.

Date: _____
_____ Landowner Signature

Date: _____
_____ Contractor Signature

Property Owner Information:

Name

Address

Telephone During Business Hours

Contractor Information:

Name

Address

Telephone During Business Hours

Arundo Mapping Procedures

Arundo donax is a non-native bamboo-like plant invading streams in the Sonoma Creek watershed. A map of Arundo infestations is necessary to develop a plan to eliminate this plant from our creeks. Information collected by surveyors using the following procedures will be entered into a map and database showing locations and other features of Arundo infestations. This map of the our watershed will allow us to develop a comprehensive management plan for this watershed to insure its future health, including the effective eradication of Arundo.

Ground Rules

Be Safe: Wear appropriate clothing, avoid unsafe terrain, poisonous plants, and wildlife. Do not enter swift water.

Be Considerate: Watch out for people around you, plants underfoot, and wildlife habitat. Pack out what you pack in with minimal impact to surroundings.

Get Permission: Talk to property owners before accessing sites.

Tools and Supplies

Data sheets

Flood maps, available from County Assessor's office

Tape measures, 100 foot and/or 25 foot

Waterproof pack for data sheets, etc

Pens and/or pencils

Clipboard

Binoculars (optional)

Compass (optional)

Tree and plant identification field guide (recommended)

Long pants, long sleeves, boots, hat (recommended)

Mapping Instructions

Form teams of two or more.

Number all sheets in advance. Keep track of last number assigned.

Fill out form as completely as possible.

Mark approximate location of Arundo clumps on flood maps with an "X". Put data sheet number next to the "X" and draw a line between "X" and data sheet number.

Estimate measurements when access is difficult or dangerous.

If unclear, ask for help.

If unsure of an answer, use your best description.

Include any additional information, history, or personal observations of site.

When completed, send sheets to [address] or call [number] for pick-up.

Questions? Call or write [name] at [organization, number, email, etc].

Arundo Donax Survey Data Sheet

Date: _____ Surveyor(s): _____

Data Sheet # _____

Name of Creek: _____ Flood Map Number: _____

Parcel Number: _____ Landowner: _____

Address: _____

Nearest Street/Intersection: _____

Site Description (Circle appropriate choices. All measurements are in feet)

Distance Across Unvegetated Waterway from Bank to Bank: _____

Width of Creekside Vegetation (distance from unvegetated channel edge to adjacent land use or next vegetation type): _____

Stream Substrate (type of material on creek bottom):

Silt Sand Gravel Cobble Bedrock
(Stones Less Than _____") (Stones More Than _____")

Surrounding Land Use:

Agriculture Residential Industrial Grass/Pasture Forest/Woodland

Physical Structures In or Near Creek:

None Bridge Rip-Rap (Rock Wall) Storm Drain Pipe

Other: _____

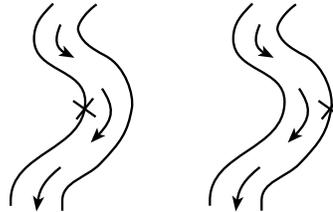
Riparian Vegetation Composition:

List the major trees and shrubs in area. Also include other non-native invasive plants, i.e. blackberry, broom, vinca, star thistle, ivy, acacia, tree of heaven, etc.

Arundo Stand Description (Circle appropriate choices)

Hydro-Geomorphic Setting (location of arundo in relation to water):

At Edge of Stream In Stream On Sand or Gravel Bar Inside of Meander Outside of Meander On Bank



Number of Clumps at Site: _____ *Distance Between Clumps:* _____

Average Height of Clumps: >6 ft 6-12 ft 12-18 ft <18 ft

Width of Clump (the shortest distance): _____

Length of Clump (the longest distance): _____

Clump Growing In: Sun Shade

If shade, species forming canopy shade:

Tree Canopy Height (approximate): _____

Health of Clump:

Bright Green Mature/Faded Green Yellowing Browned Dead

Reproduction Evidence and Growth Description:

Flower Plumes New Rooted Canes New Rooted Rhizomes New Cane Shoots Cane Branching

Other: _____

Other Information (evidence of past control efforts, possible infestation source location, property owner insights, animal sightings, and other observations):

Controlling Arundo in Your Watershed – A Guide for Organizations

A. Working with Landowners	1
B. Eradication Planning	1
General Strategy	1
Develop an Eradication Plan	2
C. Contacting Landowners	3
D. Addressing Landowner Concerns	4
Privacy Concerns	5
Erosion Concerns	5
Impacts to Natural Resources	6
Property Damage	7
Regulatory Problems	7
Personal Injury	7
E. Negotiating an Eradication Agreement	7
F. Working with Volunteers	8
G. Working with Other Stake-Holders: Agencies, Companies, and Non-Profits	9
H. More on Eradication Techniques	9
Large Scale Eradication Techniques	9
Root Excavation	9
Flail Mowing	10
Herbicide Application	10
Revegetation	11
I. Prevention and Public Outreach	11
J. More About the Identification and Biology of Arundo	12
How to Tell Arundo from Similar Species	12
Site Preferences of Arundo	12
K. Where to Get More Information	13
Eradication	14
Revegetation	14
Invasive Weeds	14
L. Credits	15
Appendix	16