

HAND PAPER M KING



HAND PAPERMAKING

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FRONT COVER: *Mulberry plant growing outside the book and paper studio at Penland School of Crafts in North Carolina. August 2009. Photo by and courtesy of Amy Richard.*

BACK COVER: *Patterson Clark, White Mulberry, June 18, 2009, 17 x 11 inches, artist-made invasive white mulberry (Morus alba) paper, ink, and block. Photo by and courtesy of the artist.*



Using Invasive Plant Fibers Responsibly

JULIE JOHNSON

Parents and children from a school environmental club harvested the invasive yellow flag iris leaves from a wetland in Portland, Oregon, September 2009. This activity required a special use permit from the sponsoring land managers. The leaves were made into cards which were sold as a fundraiser to increase invasive plant awareness in their community and to sponsor native plant purchases for the school grounds. All photos by and courtesy of the author.

ON FACING PAGE: *Pat Feeney Murrell, Merrily, Merrily Down the Stream, 2009, 10 x 18 1/8 x 2 inches (closed); French door structure with variable size, BFK Rives 140 lb. print accordion pages. Documents a Japanese knotweed eradication and stream restoration project. Photo by and courtesy of Larry Murrell.*

On a global basis...the two great destroyers of biodiversity are, first habitat destruction and, second, invasion by exotic species.

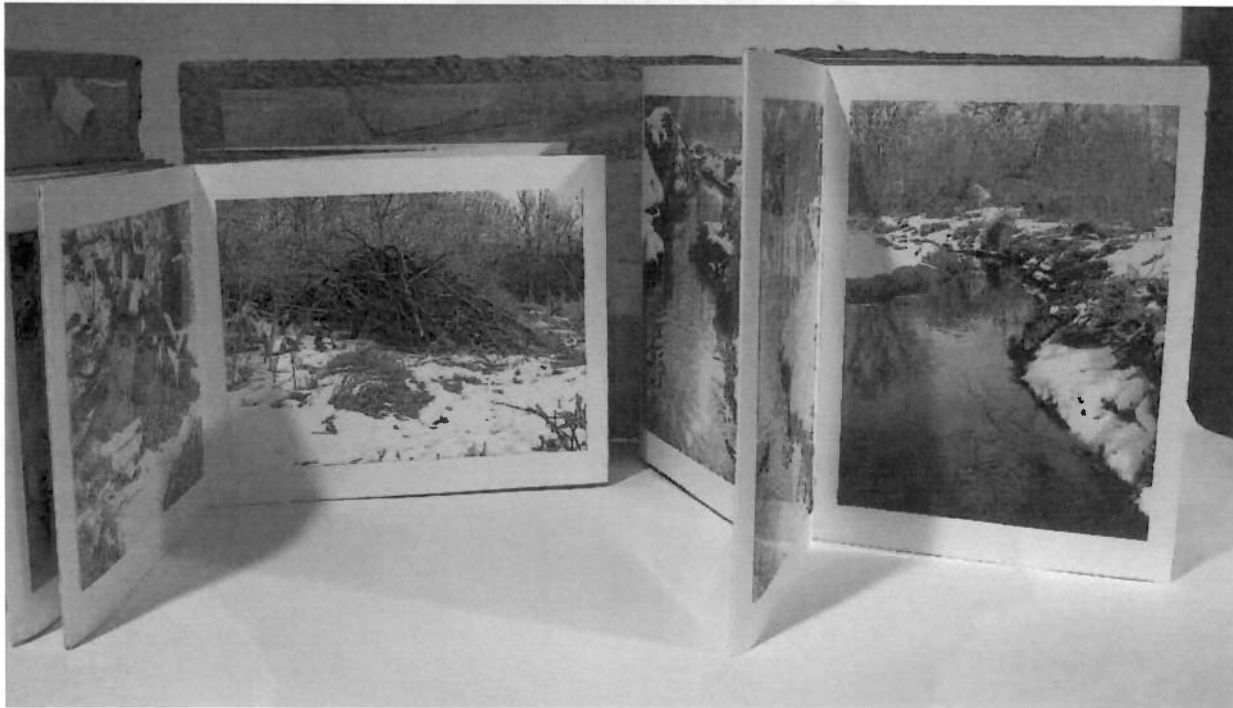
—E.O. Wilson

As a fiber artist, I have spent decades harvesting plants to make paper, baskets, cordage, and dyes. I live in the Pacific Northwest, an ecosystem rich with native plants, although increasingly threatened by invading nonnative species. I also work with a group of US Forest Service natural resource professionals charged with fighting not only nonnative invasive terrestrial and aquatic plants, but also invasive animals, insects, and pathogens. Working with Forest Health Protection experts in Oregon and Washington has given me a glimpse into the devastating economic and environmental effects of these nonnative invasive species (also referred to as NNIS, exotics, aliens, invasive weeds, invaders, and invasives).

In 1999, Federal Executive Order 11312 on Invasive Species called for federal agencies to minimize the economic, ecological, and human health impacts caused by invasive species and, as stated in the order, to: “actively prevent the introduction of invasive species; manage and control invasive species; and provide public education to support these efforts.”

The “public education” portion of this order, coupled with my knowledge of the problem, is what originally inspired me to incorporate invasive plant fibers into my art. I wanted to provide a physical link to the issue and bring public awareness to the ecological crisis by engaging with the invasives interpretively, interactively, and aesthetically.

When I started working with exotic plant fibers in the studio and in my teaching, I realized that I had a lot of research to conduct before bringing the idea to a public audience. Using invasive plants brought my own harvest, transport, and processing techniques under scrutiny. Was I, at any point in my process, inadvertently furthering the spread of invasives? Was I putting my health or the health of others at risk by unknowingly harvesting herbicide-treated plant material? Was I breaking laws simply by harvesting and transporting these weeds? Many of these questions originate from my work as a



federal employee, but I have conducted most of my research as a private citizen, working with many local, regional, county, state, and federal land management agencies, with private land owners, and conservation groups. Building relationships with and learning from the natural resource professionals in my community has been an extremely important and rewarding part of the experience.

I use invasive plants in papermaking primarily for educational purposes. I often bring pre-processed weed pulps to schools to make paper with children. Some of my favorite invasives for teaching are Japanese knotweed, yellow flag iris, and reed canary grass. If the targeted weed makes a poor-quality pulp, I add scraps of archival, cotton rag mat board from a framing shop, which adds recycling to the lesson. Discussing the weeds over a draining mould is an interactive way to increase awareness with a captive audience! For a deeper connection to the ecosystem, I have organized field trips for children (and their parents) to participate in harvesting and eradicating the plants that they use to make paper. A plant's destructive impacts are most strongly experienced firsthand, in the ecosystem. Recently I led a middle school's environmental club through the process of obtaining a special use permit to work with land managers in eradicating clumps of *Iris pseudacorus* (yellow flag water iris) from a local wetland. The children harvested the leaves, processed them into pulp, and made paper. They also dug up the roots to make dye. Because the wetland is part of their urban environment, the children now have a new sense of ownership, watching native plants become re-established at the site.

Many artists have come to use invasives in their work. One of the most beautifully synthesized approaches to invasive-plant-based education and art has been created by Washington DC artist Patterson Clark. His website, www.alienweeds.com, is a wonderfully presented educational resource and a showcase of his artwork which employs alien weeds to an exciting extreme. Clark uses exot-

ics in every step of creating his woodblock prints including the paper, ink, pigment, and woodblock. In his teaching, Clark instructs and inspires students in the use of exotics. In 2008 he taught a one-week seminar "Sustainable Papermaking with Alien Weeds" at Middle Tennessee State University. With a special use permit from the National Park Service, Clark led students through the process of responsibly harvesting and processing invasive plants, which they used to make paper, pigment, and woodblock prints.

In another twist on invasive-plant-based art, New Jersey sculptor and book artist Pat Feeney Murrell documented a stream restoration project in her artist book called *Merrily, Merrily Down the Stream*. The book bears witness to the hundreds of volunteer hours her husband Larry Murrell and members of their community dedicated to working with local officials in removing debris and eradicating a twenty-year-old monoculture of Japanese knotweed that blocked water flow and caused flooding in their neighborhood. The book documents the experience and serves as a visual aid for the benefit of other municipalities who are fighting Japanese knotweed in their riparian areas.²

Nonnative weeds are a critical and growing problem in ecosystems around the world. It is estimated that exotics have invaded up to 50 percent of America's croplands, pasturelands, and public lands; and that nonnative weeds are spreading at an alarming rate of 1.75 million acres per year, causing \$50 billion annually in environmental and agricultural damage.³ Artists who use exotics as source material must not contribute to the problem of invasive proliferation.

What follows are, at best, general guidelines to help artists minimize the potential for furthering the spread of noxious weeds.

- Identify the land owner. If it is a public agency, work with the land managers to ensure that the proposed method and timing of removal meet with existing laws, regulations, and/or policies. Obtain verbal or written permission, or special use permits as required.



Julie Johnson, The Face of Invasives, 2004, 11 inches diameter x 2 inches deep, artist-made nonnative Phalaris arundinacea (reed canary grass) paper face, painted with Hypericum perforatum (St. John's wort) flower dye, surrounded by Equisetum telmateia (giant horsetail) and Rumex crispus (curly dock) papers on a background of native Thuja placata (western red cedar) bark paper. Comment on humans causing the introduction and spread of most invasive species.

- If the targeted plants are on privately owned land, take the opportunity to educate the owner by identifying the weeds, offering assistance with eradication, and helping to reestablish native plant populations. This is a community-service opportunity that benefits the owner, the surrounding community, and the ecosystem.

- Research and thoroughly acquaint yourself with a plant before harvesting. Work with local experts to determine appropriate and legal harvest practices for eradication and prevention of spread.

- Identify how the plant propagates. Some plants are so vigorous that they can propagate not only from their roots and seeds, but also from pieces of stalk (e.g., Japanese knotweed).

- Determine any toxins that the plant may contain. Invasive plants often manufacture compounds that not only help them muscle out other plant species, but may also negatively affect humans.

- Seeds are most plants' primary dispersal mechanism, so it is important to time the harvest before seeds set and ripen. If seeds are present at harvest, place a bag over the entire seed head and snip directly into the bag. Secure and dispose of bags in regular garbage, not yard debris or compost.

- Transport plant material only after it has been 100-percent contained and secured in heavy duty, thick-walled plastic trash bags. Some invasive species are so insidious that land management policies require on-site incineration of plant material, not removal (e.g., rice bulrush on national wildlife refuges in the state of Washington).

- Process live plant material indoors to prevent introduction. If you process outdoors, do it on a hard surface like a deck, patio, or driveway so plant fragments can be easily identified and contained

- After processing, secure leftover, unused plant material in bags and dispose in the regular garbage. Composting or dumping NNIS in yard debris can lead to widespread dispersal when plant parts or seeds escape from commercial or personal composting sites. This is especially true for those located near green spaces and urban interfaces.

- Do not send plant material, seeds, or paper made with seeds to other parts of the country or to other parts of the world! After experiencing severe ecological and economic damage from NNIS, many countries have strict laws prohibiting the introduction of unregulated plant material.

- Remember that locally native plants can be invaders in a foreign ecosystem. Further, locally native insects and/or diseases that plant materials harbor can be even more destructive than plants to a foreign ecosystem. Some examples of nonnative insects that have wreaked havoc in the United States are emerald ash borer, hemlock woolly adelgid, and the Asian longhorned beetle. Devastating nonnative disease pathogens include sudden oak death, chestnut blight, white pine blister rust, and Dutch elm disease. Often the only viable control measure is a preemptive removal of the entire host species within a quarantined area.

Legally harvesting any plant material—even weeds—on managed lands often requires a special use permit. Usually there is no fee, but the permitting process collects useful data such as timing, location, plant species, intended end use of the plant material, and removal and disposal techniques. Obtaining a permit may take anywhere from one week to a month or more, depending on the detail required in establishing mutually agreed upon parameters that ensure compliance with land management laws, rules, and



Patterson Clark, 3 Weed Note, 2009, 11 x 17 inches, artist-made ivy (*Hedera helix*) paper, white mulberry (*Morus alba*) wood block, and *Rosa multiflora* ink. Photo by and courtesy of the artist.

policies. One extremely important reason for participating in the permitting process is to avoid contact with herbicides. Almost all public and private land managers agree that herbicides are often the only effective treatment in eradicating certain invasive plant species. Some plants even require multiple years of treatment before a population is wiped out. The formal permitting process allows managers to help you identify areas that have not been treated, and to schedule control measures around your harvest.

Laws, control measures, and eradication regimes can vary from plant to plant, from site to site, and from agency to agency. Even if a special use permit is not legally required, establishing contact with the land manager is in everyone's best interest. Managers can help determine sites, allow access to areas that may not be normally available to the public (i.e., via closed roads), and provide plant-specific removal techniques and timing that align with larger ecosystem restoration efforts.

Volunteering for organized weed removal efforts can be an efficient way to obtain large amounts of untreated invasive plant material, but depending on the sponsoring agency or group, a special use permit may still be required for transport and use of the weeds. Establishing contact with the project coordinator well in advance of an event helps to ensure that the targeted plants are available.

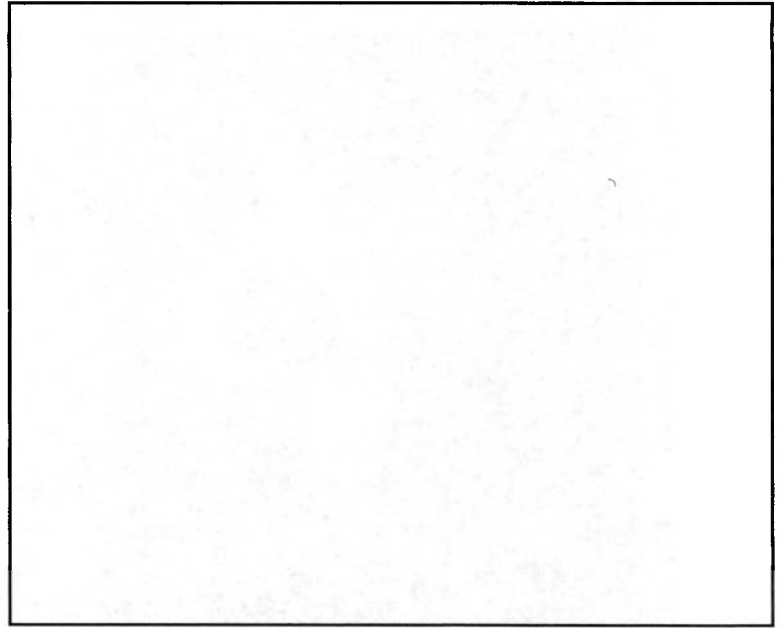
When artists incorporate exotics into their work, they establish a beneficial relationship with these plants and may learn to appreciate their positive traits. It is therefore easy to lose perspective on the continued diligence required to minimize the devastating ecological impacts of invasives. Whether for large-scale biomass removal or small-scale individual use, the motivation for using in-

vasive weeds is ultimately to help eradicate these plants from the landscape. This is one natural resource where over-consumption can be indulged, guilt-free.

Patterson Clark eloquently terms his woodblock prints, "endless-edition prints (to be printed as long as the plants provide...)." Here's to a lack of source material to turn his prints into limited editions! The year we seek our favorite invasive species and simply cannot find them will be cause for celebration, and an opportunity to reacquaint ourselves with the sustainably diverse and inspiring fibers found in balanced, native plant populations.

NOTES

1. Executive Order no. 13112 on *Invasive Species*. Federal Register 64, no. 25 (February 8, 1999): 6183–86.
2. Details of the community-based stream restoration project are available at <http://www.stopknotweednj.com>.
3. Dave Pimentel of Cornell University's College of Agriculture and Life Sciences, quoted in Erik Lacitis, "In War on Weeds, the Bug Lady Bets on Hungry Weevils," Seattle Times, August 17, 2006, http://seattletimes.nwsources.com/html/localnews/2003204493_buglady17m.html (accessed October 25, 2009).



Paper made from Japanese knotweed, harvested April 25, 2009

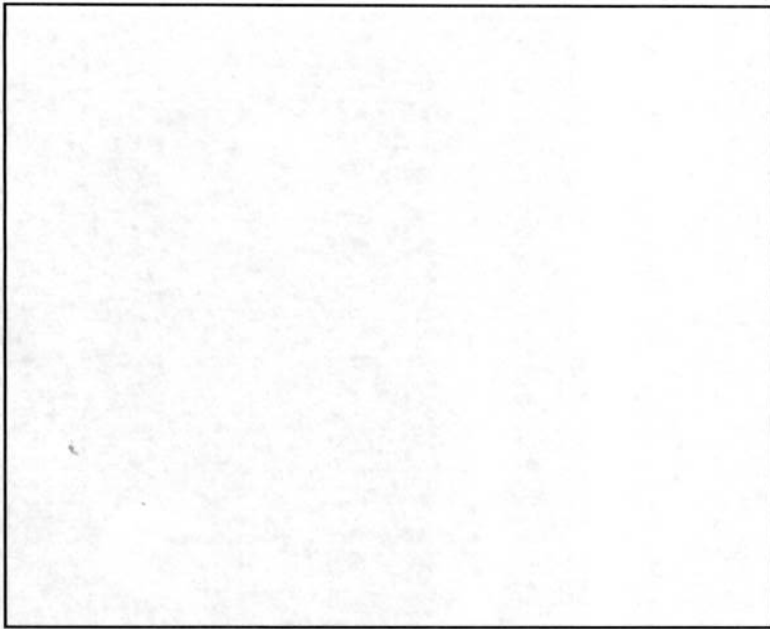
*Paper Samples: Comparing
Japanese Knotweed Fibers
Harvested Three Weeks Apart*

JULIE JOHNSON

For these two paper samples, we harvested four- to six- foot tall Japanese knotweed (*Polygonum cuspidatum*) stalks on April 25, 2009 and then three weeks later on May 16, 2009. We processed the plants from each harvest separately using the steps outlined below.

We handled the plant material indoors and disposed the top and bottom ten inches of each stalk and all of the leaves in well-secured, black plastic bags in the trash (not compost). We filled three-gallon stainless steel pots with one-inch pieces of cut stalks, added enough water to cover the plant material, and sprinkled in three ounces of lye to make a 10 percent lye solution. We cooked the knotweed for 45 minutes, then rinsed it thoroughly, and beat the cooked pieces for three hours in a two-pound Mark Lander Hollander beater.

I pulled the paper Western style, waterleaf (no sizing), then wet-pressed the post for half an hour in a hand-crank press, and put the wet sheets under restraint for twelve hours in a drying box. Afterwards I put the dry sheets under weight between smooth boards for a week.



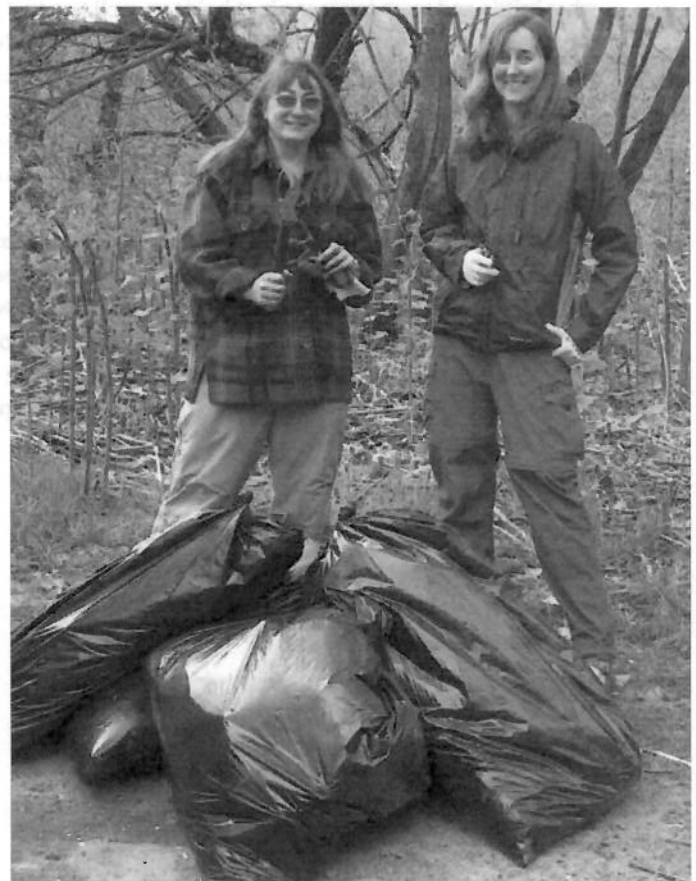
Paper made from Japanese knotweed, harvested May 16, 2009

In comparing the two paper samples, it is clear that the timing of the knotweed harvest can result in widely varying fiber qualities. The April swatch is brown in tone, exhibits high shrinkage, and has a greater translucency than the swatch made from May-harvested fiber. While the April paper is somewhat brittle and tears fairly easily, it holds up well to a fold test, demonstrating the underlying strength of this fiber, even when harvested very early in the season. The May swatch, with its tough, partially unprocessed fiber strands, is more difficult to tear and also holds up very well to a fold test. As the plant matures, the resulting paper becomes more yellow. Knotweed plants harvested after June yield a very tough fiber that becomes increasingly difficult to break down as the season progresses.

While these samples are a good comparative illustration of how harvesting times greatly impact the fiber for papermaking, alas, neither of these swatches truly showcase the excellent paper qualities that knotweed offers. To make a finer quality May paper, I would use a stronger lye solution, a longer cooking time, and/or an extended beating time. However for the sake of direct comparison between these two swatches, I used the same processing steps for both harvests.



To make the Japanese knotweed paper samples, the author Julie Johnson (pictured on left side in lower right photo), Alexandra Schaefer (also pictured in these photos), and Ben Smith harvested and processed the plant material on the Sandy River, near Portland, Oregon. They harvested knotweed stalks that are 3/4 to 1 1/2 inches in diameter and 4 to 6 feet tall. The roots were left undisturbed and 2 to 3 inches at the base of the cut stalks were left intact to aid land managers in locating the plants for eradication. They secured the cut stalks (with leaves intact) in heavy-duty black plastic bags for removal from the site. Japanese knotweed can propagate and create new plants from small stem fragments (in addition to root pieces and seeds), so the plants were processed indoors to ensure 100% containment. The author wishes to thank Russ Plaegar of the Sandy River Watershed Council for his help in locating the untreated knotweed.





A Papermaker's Dilemma: Examining the Use of Invasive Plants

AMY RICHARD

Paper mulberry (Broussonetia papyrifera or kozo) can be found growing in abandoned lots and disturbed lands in northeast central Florida. This photograph, taken in September 2009, shows a perfect example of how the plant crowds out native species like the wax myrtle (pictured in the center), eventually creating a monoculture. All photos by and courtesy of the author, taken in Gainesville, Florida.

For many papermakers, a chance to harvest locally grown kozo (*Broussonetia papyrifera* (Vent.) or paper mulberry) for the purpose of making Japanese paper is an exciting prospect.

A few years ago, after discovering a large stand of these plants growing within just a few miles of my home in north central Florida, I became determined to try my hand at the age-old Japanese papermaking process, beginning with harvesting the raw material. I was enchanted with the sense of accomplishment found in a stack of freshly cut branches; the earthy aroma of the sticks as they steamed over a fire; the satisfaction of scraping away black bark from the silky inner bast fibers in one smooth motion; the feel of the crisp finished paper; and the warmth of its lovely golden hue. Before long, I developed the ability to spot kozo plants, with their telltale mitten-shaped leaves, alongside roadways while driving at high speed. Abandoned lots and utility right-of-ways, which seemed to be full of these plants, were duly noted for potential harvest sites each winter.

Like a youngster with unlimited access to a cookie jar, I tried to ignore the nagging doubts that began to grow when I realized that this same shrubby tree species, cultivated and highly prized in Japan, is weedy and invasive in many natural areas throughout Florida. "Problem solved," one might think; artists can harvest the material for their own use and help the environment at the same time.

If only it were that simple. As coordinator of the Florida Invasive Plant Education Initiative, I am surrounded by an abundance of information on the risks associated with harvesting and using invasive plants.¹ Kozo is one of 130 plant species considered invasive in Florida.² In 2004–2005, over \$37 million were spent controlling invasive plant species in the state's aquatic, wetland, and terrestrial habitats.³ While the big dollar figure is alarming, it is the hundreds of photographs that have come across my desk that worry me the most—images of invasive species gone wild, covering forests, lakes, rivers, or wetlands, choking out native flora and fauna and threatening Florida's biodiversity. Trips to field sites, where a single species has created a monoculture as far as the eye can see, have left a lasting impression.



Paper mulberry plants have highly variable leaves ranging in size from 3 to 10 inches long. A combination of leaf shapes may be found on one plant or they may all be the same. Smaller leaves tend to be egg-shaped with pointed tips and serrated edges (margins). This tree is growing just outside the book and paper studio at Penland School of Crafts in North Carolina. August 2009.

It can be a prickly subject, which is why my intent is not to preach but to present a yellow blinking light: a warning signal for us to reduce speed and take a closer look before proceeding. As one scientist warns, “For invasive species, the stakes are higher than for most other forms of pollution because once a species is established and has begun to spread, the introduction is irreversible.”⁴

Unlike many agricultural and/or horticultural plants, some nonnative species are able to flourish outside of cultivation.⁵ Because these plants are beyond their native range, their natural enemies (e.g., bacteria, fungi, insects, herbivores) are not present, giving them a huge advantage and allowing them to cover or shade out native plants and/or drive away native wildlife that have evolved within an ecosystem.⁶ Once the presence of a nonnative species results in economic or environmental harm to human, animal, or plant health, it is defined as invasive.⁷ Throughout the United States, invasive species (including animals) are causing environmental damage and losses totaling an estimated \$137 billion per year.⁸

Like many of the invasive plants that we are trying to control today, kozo was introduced into the United States with the best of intentions. One source dates its introduction in Virginia as early as the 1830s as a potential papermaking fiber, back when the number of American paper mills was growing and sources for cotton rag were dwindling.⁹ Since then, it has become naturalized—reproducing on its own outside of cultivation—in many neighboring states. In numerous instances, this is the first step towards becoming invasive. In Florida, kozo plants were reported as early as 1903.¹⁰ It is now documented in every corner of the state.¹¹

The degree of kozo’s invasiveness depends on region, climate, and soils. The USDA Plants Database documents the occurrence of *B. papyrifera* in at least 20 states in the United States, but that



Larger paper mulberry leaves tend to be heart or mitten shaped, some are deeply notched with three large or two smaller lobes near the base of the leaf. Soft hairs on the stems and leaf undersides are other distinguishing characteristics. November 2009.

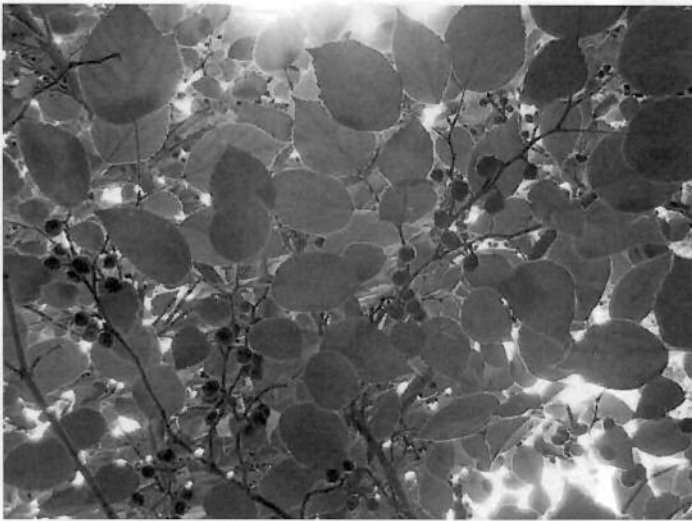
does not mean that the plant has been assessed in every state.¹² To date, it is considered invasive in natural areas in at least 11 of the 29 states: Florida, the District of Columbia, Georgia, Louisiana, Maryland, North Carolina, Oklahoma, Pennsylvania, South Carolina, Tennessee, and Virginia. Also, it is reported to be invasive in more than a dozen other countries.¹³

Numerous state and federal publications agree on the negative environmental impacts of paper mulberry:

- It exhibits aggressive growth, quickly invading open habitats such as forest and field edges or disturbed lands, displacing and out-competing native vegetation;
- It negatively impacts wildlife dependent on native vegetation for forage, nesting, and cover;¹⁴
- Its fruits can be spread significant distances by wildlife, enabling it to spread deeply within undisturbed areas;
- Once established, paper mulberry spreads from its root system, forming dense thickets, which are often 30 feet across.¹⁵

In addition to producing thousands of seeds, mature paper mulberry trees, growing to heights of more than 30 feet, spread vegetatively by sending up vertical shoots or “suckers” from underground stems (rhizomes) that reach as far as 30 feet from the parent plant. This shallow web-like system prevents other plants from growing in the understory and results in a monoculture of paper mulberry. In every location where I have found it, this root system was present and seemed to extend even farther.

With all of this said, *B. papyrifera* is, at the present, considered to be somewhat less egregious when compared with other invasive species in Florida. According to the IFAS Assessment, used by the University of Florida, Institute of Food and Agricultural Sciences (IFAS) to evaluate invasiveness in the state, paper mulberry “may be recommended with caution” and “managed [as] to prevent escape.”¹⁶ Florida’s Exotic Pest Plant Council (FEPPC)



Even this small shrubby-sized paper mulberry plant produces many fruits and consequently, seeds. Mature trees produce many more seeds in addition to spreading by horizontal underground stems (rhizomes) that sprout new plants or "suckers" as far as 30 feet from the parent plant. This tree is growing outside the book and paper studio at Penland School of Crafts in North Carolina. Small suckers were observed by the author at least 40 feet from this tree. August 2009.

ranks paper mulberry as a Category II species, "an invasive exotic that has increased in abundance or frequency but has not yet altered Florida plant communities to the extent shown by Category I species (i.e., positively invasive)." They follow up by stating, "This species may become ranked as Category I, if ecological damage is demonstrated."¹⁷

B. papyrifera has not shown up yet on the Florida noxious weed list so it is not "officially" a problem to harvest it from existing stands.¹⁸ However, at least one individual in the plant management arena is now considering recommending that kozo join the list.¹⁹ If you are contemplating the use of kozo or another plant found somewhere other than on your own property, research may be warranted. Most states have laws limiting or restricting the transport or possession of certain plants; some require a permit, others are prohibited altogether (i.e., illegal to possess or transport). Your state's noxious weed list is a good place to start.

Noxious weed lists and laws were created because harvesting known invasive plants can help to spread the plant, especially if seeds or fruit are present. Collecting material in the winter when the plant is dormant or before it produces seed or fruit can help reduce the risk. When harvesting an invasive or even a potentially invasive plant, it is also recommended that any extra material be collected and disposed of properly, especially material with attached seeds or spores, or plant parts capable of vegetative reproduction.²⁰ Some land managers have been known to use tarps or tight-meshed ground cloths for this purpose. Proper disposal involves burning, freezing, or putting all materials in household trash that is destined for the landfill, far away from a compost pile. As well, viable parts of invasive plant species should never be discarded with yard waste that may be provided as mulch to other homeowners.

For kozo specifically, the Japanese tradition of harvesting



Paper mulberry trunks are also quite variable. Some are pale brown or silvery gray in color. Others sport tiger stripes, shown here. Notice the absence of any ground vegetation, a product of its dense leaf canopy shading out the understory and its shallow web of underground roots preventing other plants from growing. November 2009.

branches in the winter seems to work although I have adopted the practice of collecting and burning extra material in the backyard fire pit as additional insurance.

When I first learned "Florida kozo" was invasive, I spent considerable time wondering if there was any way to safely cultivate it. Professor Ken Langeland, an invasive plant expert at the University of Florida, confirmed my suspicions with one word: "Don't." In his opinion, kozo is one of the worst landscape weeds he has seen.²¹ Like me, he battles to control the endless suckers that sprout up all over his yard, new plants attached to underground rhizomes, all of which lead to a parent tree in a neighbor's yard. Without removing the parent tree and all existing suckers, it is a futile effort.

His professional insight and my own personal experience with this plant further increase those twinges of guilt I experience when harvesting branches from local naturalized stands. If I care about the natural diversity of the habitats around my home, shouldn't I be willing to permanently remove these plants, especially in areas where they are clearly a problem?

While I have volunteered to remove other invasive plant species, I have not quite reached the point of treating a thriving stand of paper mulberry saplings with herbicides (i.e., the only viable way to control large infestations). But I'm close. After seeing some



"Florida kozo" saplings continue to sprout just steps from the author's studio and 40 feet from a parent tree that was blown down during one of the many hurricanes that visited Florida in 2004. January 2010.



A mature "parent" paper mulberry tree located two lots over from the author's house continues to introduce new plants to the neighborhood, in every direction. February 2010.

of the local kozo populations, I have become increasingly uncomfortable with harvesting branches without also trying to remove the plant. Even though I am keen on access to such a wonderful fiber, I am also quite fond of Florida's beautiful and unique natural areas, wild places that could be threatened by a monoculture of paper mulberry.

Many of us, including me, are uncomfortable with the use of chemicals in the natural environment. However, as I have learned from working at the Center for Aquatic and Invasive Plants, the research behind the use of herbicides is much more thorough than in years past and regulations are far tougher. Working with a host of plant managers who are knowledgeable and dedicated to environmental safety has also increased my comfort level.²²

For many plant infestations, herbicides have proven to be the only economical and ecological means of control, especially for plants like hydrilla, an aquatic species that can re-sprout from a tiny fragment fallen off a boat trailer and grow an inch or more a day.²³ The same is true for upland plants like the air potato vine, which can grow up to eight inches in a day.²⁴ There is really no way to effectively control these situations without herbicides. As well, other methods like the use of mechanical harvesters have their own problems, such as high mortality rates of fish and turtles killed in the machinery as it scoops up aquatic plant material.²⁵ For this reason, virtually every governmental agency and many con-

servation organizations support or use herbicides as part of their toolbox for managing invasive vegetation.

When working with found plants, I have learned that it is always a good idea to consult with the experts and there are plenty who are ready to share their knowledge and expertise. They can be found by contacting local or state environmental agencies or university cooperative extension services. Many states or regions have native plant societies and pest plant councils that are comprised of plant management professionals.

To ease my own conflict with using invasive plants, I will continue to use "best management practices," and seek partnerships with land managers in the area to coordinate my harvest along with their control efforts. And (sigh), I will also be exploring the cultivation and use of other *non-invasive* fibers such as flax or Dahlia...or perhaps, our native red mulberry.

NOTES

1. University of Florida/Institute of Food and Agricultural Sciences, Center for Aquatic and Invasive Plants, <http://plants.ifas.ufl.edu>.
2. Florida Exotic Pest Plant Council, Florida Exotic Pest Plant Council Invasive Plant Lists, <http://www.fleppc.org/list/list.htm> (accessed February 24, 2010).
3. Kenneth A. Langeland, UF/IFAS Center for Aquatic and Invasive Plants, personal comment to author, February 8, 2010. This figure includes both research and management costs.



"Globose" or ball-shaped paper-mulberry fruits surround a single female inflorescence with a few remaining flowers still attached. Courtesy of UF/IFAS CAIP.

4. David M. Lodge and Kristin Shrader-Frechette, "Non-indigenous Species: Ecological Explanation, Environmental Ethics, and Public Policy," *Conservation Biology* vol. 17, no. 1 (February 2003): 31–37.
5. Nonnative describes any species that is present in a region outside its original, historic range due to intentional or unintentional introduction; also referred to as non-indigenous or exotic. The term nonnative does NOT necessarily mean it is invasive. In Florida, the majority of an estimated 1,300 nonnative plant species are not causing problems. Some are beneficial. For more information, see Vic Ramey, "Non-Native Invasive Plants: An Introduction," from the *Plant Management in Florida Waters* website, <http://plants.ifas.ufl.edu/guide/invplant.html#stewardship> (accessed January 30, 2010).
6. "Native" describes any species occurring naturally in a geographic region; also referred to as indigenous. In the United States, plants are generally considered native if they were here before the arrival of Europeans (i.e., Columbus). Source: Richard P. Wunderlin, © 2006 Institute for Systematic Botany, as quoted in the *Plant Management in Florida Waters* website, <http://plants.ifas.ufl.edu/guide/invplant.html> (accessed February 23, 2010).
7. *Invasive Species Definition Clarification and Guidance White Paper*, Submitted by the Definitions Subcommittee of the Invasive Species Advisory Committee (ISAC), for the National Invasive Species Council (April, 2006). The document, available online, offers a great deal of information: http://www.invasivespecies.gov/global/ISAC/ISAC_documents/ISAC%20Definitions%20White%20Paper%20%20FINAL%20VERSION.pdf (accessed February 24, 2010).
8. David Pimentel et al., "Environmental and Economic Costs of Nonindigenous Species in the United States," *BioScience* vol. 50, no. 1 (January 2000): 53–65.
9. Edmund Fulling, "Botanical Aspects of the Paper-Pulp and Tanning Industries in the United States—An Economic and Historical Survey," *American Journal of Botany* vol. 43, no. 8 (Oct. 1956): 621–634.
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11. Eric Morgan and William Overholt, *Wildland Weeds: Paper Mulberry, Broussonetia papyrifera*, University of Florida/IFAS Publication ENY-702 (Gainesville: Entomology and Nematology Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, March 2004). Also available online at <http://edis.ifas.ufl.edu/in498> (accessed February 24, 2010).
12. See profile of paper mulberry on the USDA Plants Database, <http://plants.usda.gov/java/profile?symbol=BRPA4>; and on the Invasive Plant Atlas of the United States, <http://www.invasive.org/weedus/subject.html?sub=5208> (both accessed February 24, 2010).
13. J.M. Swearingen, "Paper Mulberry," Alien Plant Working Group Least Wanted, on the Plant Conservation Alliance's website, <http://www.nps.gov/plants/alien/fact/brpa1.htm> (accessed February 24, 2010).
14. Lorraine Miller, Paper Mulberry, *Broussonetia papyrifera*, Invasive Plant Species, National Forests in Florida Protection Report R8-PR 46 (USDA Forest Service, Southern Region, 2000).
15. Eric Morgan and William Overholt, *Wildland Weeds: Paper Mulberry, Broussonetia papyrifera*. See endnote 11.
16. The University of Florida's IFAS Assessment project was created to provide recommendations concerning the use of nonnative plants in Florida. For more information, see <http://plants.ifas.ufl.edu/assessment/> (accessed December 10, 2009).
17. Florida Exotic Pest Plant Council (FLEPPC) is a non-governmental organization comprised of plant management experts from around the state. One of their self-assigned tasks is to assist land-managers by setting priorities for invasive plant control programs through the maintenance and continuous review of the Invasive Plant Species, a biennial list supported by current ecological observations in the field plus information in several statewide plant databases and herbaria, <http://www.fleppc.org/list/list.htm> (accessed January 20, 2010). Information specifically on kozo's classification in other states can be found from a number of resources, starting with these websites: <http://plants.ifas.ufl.edu/node/634>, <http://www.naeppc.org/>, and <http://www.eddmaps.org/species/> (all accessed February 24, 2010).
18. The Florida noxious weed list is available on the website of Florida Department of Agriculture and Consumer Services, Division of Plant Industry, <http://www.doacs.state.fl.us/pi/enpp/botany/noxweed.html> (accessed February 10, 2010).
19. Ken Langeland, UF/IFAS Center for Aquatic and Invasive Plants, personal comment to author, February 8, 2010.
20. Ken Langeland, Help Protect Florida's Natural Areas from Non-Native Invasive Plants Circular 1204 (Gainesville: Agronomy Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, first published March 1998, revised February 2009). Also available online at <http://edis.ifas.ufl.edu/ag108> (accessed February 24, 2010).
21. Ken Langeland, UF/IFAS Center for Aquatic and Invasive Plants, personal comment to author, February 2010.
22. For an interesting video presentation on the safety of herbicides, see Carole Lembi, "Why Aquatic Herbicides Affect Aquatic Plants and Not You!" on the website of the Department of Botany and Plant Pathology, Purdue University, <http://www.btny.purdue.edu/Aquatic/aquaticherb.html> (accessed February 4, 2010).
23. Gerda Van Dijk et al., "Growth of Hygrophila and Hydrilla In Flowing Water," *Journal of Aquatic Plant Management* 24 (1986): 85–87.
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