
Mississippi Native Plant Quarterly

Mississippi Native Plant Society

FEBRUARY 1994

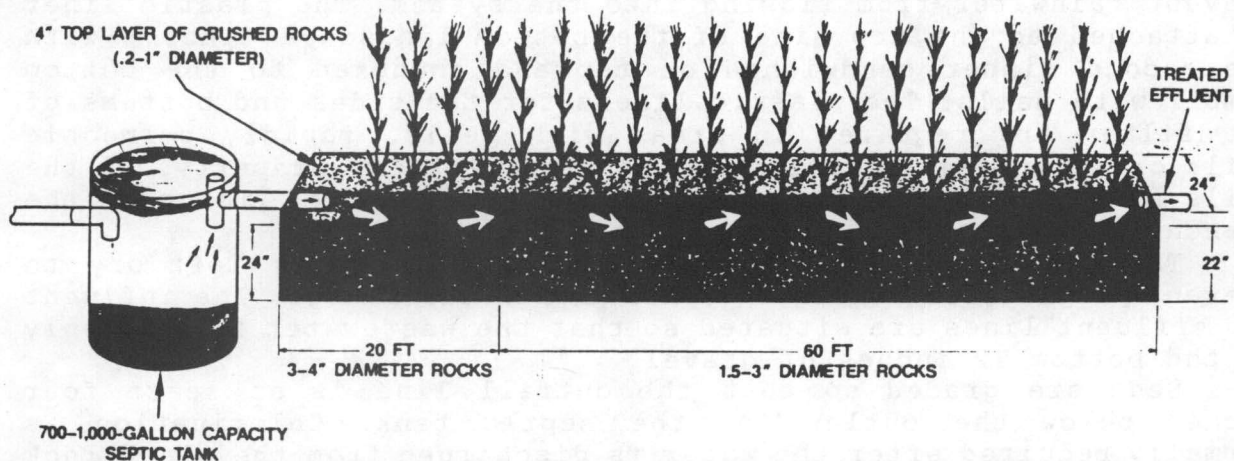
Home plant/rock filters reuse wastewater and recycle nutrients

by Becky Gillette

It stinks. That sums up what happens in areas without centralized sewer systems when septic tank leach fields fail due to high water tables or soil types that don't percolate adequately. Where I live on the rapidly developing Mississippi Gulf Coast, most of the soils from the Coast to 10 to 15 miles inland aren't adequate to support septic tank leach fields. Yet thousands of homes rely on septic tanks for sewage treatment.

Besides the unpleasant odor, insufficiently treated sewage can harm the natural environment; excess nutrients from the wastewater can contribute to algae blooms that deplete the water of oxygen and cause the death of fish and other aquatic organisms. The sewage also presents a health hazard because of the possibility of transmitting disease. Then there's the economic loss associated with untreated sewage entering the bays: oyster reefs can't be harvested because of fecal contamination.

There is a relatively low-cost solution for troublesome septic tank discharges, one that can look and smell so beautiful that few would guess its underlying function. The solution, known as a plant/rock filter system or as an artificial marshland wastewater treatment system, uses common plants such as canna lily, elephant ears and water iris to "farm" the wastewater after discharge from the septic tank.



Septic tank with plastic-lined plant/rock filter system

The plant/rock filters can be designed as attractively as any flower bed. So, not only do the plants and microbes associated with the plant root digest organics and bacteria, but homeowners get the bonus of beautiful landscaping that never needs watering or fertilization. Plants such as butterfly weed (Asclepias tuberosa) that feed hummingbirds and butterflies can be used, allowing wildlife to benefit from man's waste. In arid areas, the wastewater could be a great asset when reclaimed to water the rest of the yard.

The home plant/rock systems are the brainchild of Dr. Bill C. Wolverton, who has designed numerous artificial marshland wastewater treatment systems. Mississippi was the first state to license the use of plant/rock filters for home wastewater treatment. There are now estimated to be more than 500 of the systems in operation across the state. The use of the systems has also spread to other states with similar problems.

The plant/rock filters use human wastewater as a hydroponic solution to grow plants in a trench lined with 21-mil plastic and filled with wash gravel. A septic tank is still used for primary treatment. In new installations, the septic tank is elevated slightly above the surface of the ground so that the effluent can discharge into the filter by gravity flow. If the filter is added to an existing septic tank, a pump is installed to bring the water up to the bed.

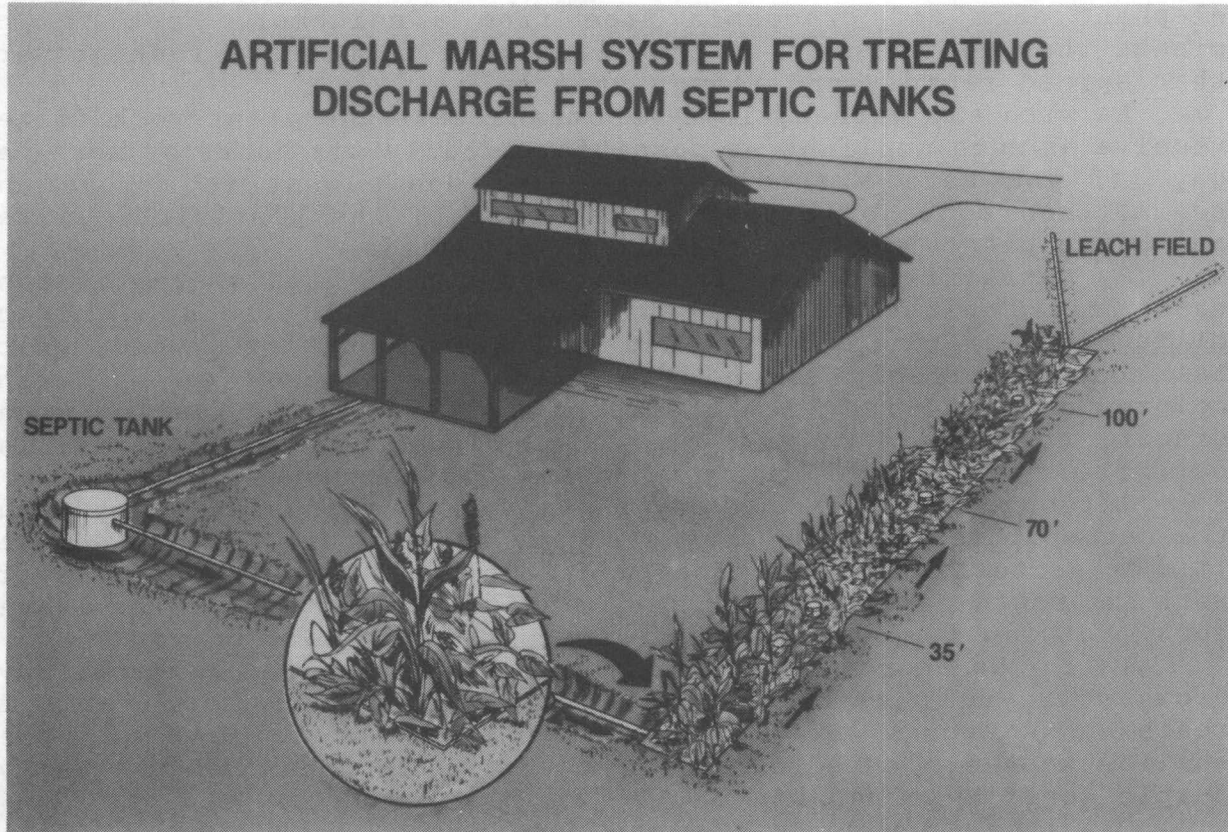
In Mississippi, the plant/rock filters required by the health department are 18 inches deep. Beds of 300 square feet are required for a three-bedroom or less home, and 400 square feet for a four bedrooms or more. Or, 12-inch deep trenches totalling 600 square feet for three bedrooms or less and 800 square feet for four bedrooms or more can be used. Because the standard size for the plastic liner is 12 feet, most plant/rock beds in this area are eight feet wide, leaving room for the liner to be attached to the landscape timbers lining the sides of the filter.

Two tiers of treated four-inch by six-inch landscape timbers are normally used to help form the sides of the bed, as well as prevent rainwater from flowing into the system. The plastic liner is attached to the top side of the bottom landscape timber, with the second timber sandwiched on top and anchored to the bottom timber with nails. The plastic liners for the sides and bottoms of the filter are required in areas with wells, rapidly permeable soils or other sensitive areas such as waterfront property. If the soils aren't permeable and there is no well nearby, lining of the trench isn't necessary.

The top six inches of gravel in the filter is left dry to prevent people from coming in contact with the sewage. The influent and effluent lines are situated so that the wastewater is held only in the bottom 12 inches of gravel.

Beds are graded so that the outfall line is at least four inches below the outlet for the septic tank. Chlorination is normally required after the water is discharged from the plant/rock filter into a shallow subsurface absorption field or by overland flow. About 200 linear feet of field line is required for the

ARTIFICIAL MARSH SYSTEM FOR TREATING DISCHARGE FROM SEPTIC TANKS



discharge. If the water table is too high for a field line, as is common here on the Coast, an option is a 100-square-foot unlined gravel bed for overland discharge. Plants are also placed in this gravel bed.

In the Gulf Coast area, prices for installing a septic tank and plant/rock filter start at about \$2,200, which doesn't include the cost of purchasing and installing the plants. Attaching a pump and rock/reed bed to an existing below-ground septic tanks runs about \$1,500. Homeowners are required to use an installer licensed by the health department and, as with any other contractor, I'd highly recommend checking references before hiring someone. While the systems aren't that difficult to install, they must be graded properly.

Most installers in my area put the systems in, and leave the planting to the homeowners. Unfortunately, some homeowners don't realize that the plants are a vital part of the system; it simply won't work adequately without them.

In our area, plants can be obtained for little or nothing.

Elephant ears, cattails and other wild aquatic plants can be gathered from roadside ditches. I got my water iris, canna lilies, elephant ears and crocosmia free from a neighbor. Most of the plants that do the best in the plant/rock filter are rank growers that spread rapidly and flower profusely.

As with any garden, it's important that the plant/rock filter receive as much sunlight as possible, ideally six hours or more per day. If you have a shadier site, and don't want to remove any trees, then consider expanding the size of the plant/rock filter and using plants that grow well in part shade.

My marsh filter also includes bananas, a popular septic tank drain field plant here on the Gulf Coast; hibiscus (Hibiscus militaris plus some domesticated varieties); butterfly weed, which has reseeded freely around the filter; a rainbow of different colored canna lilies; lemon grass, which makes an excellent tea; ginger; climbing roses; aromatic ginger lilies; amaryllis; daylillies; crocosmia; and even a few azalea bushes.

Although they spread very rapidly, I'm gradually phasing out the canna lilies because they are very susceptible to worm damage. It's an aesthetic, rather than functional problem. The cannas still work for waste purification, but I don't like how ragged the leaves look. Nothing I've tried for organic control seems to work.

I'll also be removing the azaleas and daylillies. Neither have grown very well; shallow rooted plants don't seem to be able to reach deep enough to get the water they need. Several other shallow-rooted plants that didn't thrive include yarrow, tansy, purple coneflower and mint.

One thing you don't want to put in the plant/rock filter is trees, which can have such dense roots that they will clog the flow of the filter. However, I've planted water-loving trees such as willow and mayhaws outside my plant/rock at the discharge point.

Concerning planting the filter, the thicker the plants are, the better. But it's not easy digging the gravel out deep enough to put plants in the recommended one-foot spacing because the gravel tends to fall back in the hole while you're digging. An option we came up with is using a 12-inch piece of plastic pipe as a cofferdam to hold back the gravel while we put the plants in.

Ideally the filter should be planted before any wastewater is discharged into it. A seasons' growth, or at least a month or two of growth, would be best. However, in most cases in my area the systems are put into use immediately. In this subtropical climate, the plants grow very rapidly, and you can have good plant coverage in just a couple of months.

If you do any planting after the wastewater is in the system, be sure to wear rubber gloves and wash up afterwards. If you're like me, you may want to move things around until you get the most pleasing mixture of flowers.

Some people question how well the plant/rock filters function during periods of heavy rainfall. Wolverton says that under those conditions, water won't be retained as long in a home system, but treatment should still be adequate. He adds that since wastewater is heavier than rainwater, the rainwater is likely to run off

first, leaving the wastewater deeper in the bed. Municipal systems, in my opinion, aren't any better at coping with heavy rainfall. The operators call it an "act of God", and open the flood gates when they get rainfall amounts that overwhelm their systems.

Wolverton says the home plant/rock systems, like their larger municipal cousins, continue to function even during winter. He says most of the biological action in the system occurs at root level, and that action continues even during cold weather. Although most systems tested thus far have been in the South, there is evidence they work in colder climates as well, even under a cover of snow.

Remove dead leaves from plants that are killed by frost. One good native preferred because it doesn't die back in the winter is the Louisiana water iris. There is also a native species of Juncus that stays green all winter.

Concerning maintenance, little is necessary outside of that needed for any flower bed. IF the system ever back ups, plant roots may have gotten so thick that they are clogging the effluent discharge. The solution is thinning the plants around the discharge.

One important maintenance item is the septic tank. Two-cell septic tanks are ideal (when you double the retention time in the septic tanks, you quadruple treatment), but here most people use only one septic tank. A septic tank will eventually fill with solids, and should be checked after the first five years of operation, and every two to four years after that. When the depth of the bottom sludge is one-third of the distance from the tank bottom to the outlet pipe, it should be pumped. If allowed to fill with solids, the septic tank solids will clog the filter.

The best research now with the small systems is coming from the Tennessee Valley Authority, which has produced a technical report series titled, "General Design, Construction and Operation Guidelines: Constructed Wetlands Wastewater Treatment Systems for Small Users Including Individual Residences," Second Edition. The report was prepared by Gerald R. Steiner, P.E. and James T. Watson, P.E. The report is available by calling 615-632-6433. The report goes into detail on basics of design and construction, hydraulic and organic loading, water level control and operation and maintenance.

The TVA makes a couple of recommendations that aren't in common use here, but which have merit. One is placing larger diameter rocks, (two- to four-inch stone compared to the average of 1/4 inch to 1/8 inch for the gravel) for a couple of feet around influent and effluent lines to reduce clogging potential. TVA also recommends capped cleanouts on the influent and effluent distribution pipes.

Home rock/plant filters are still new. There's still much to be learned about fine-tuning them for optimum results. But they have the potential to change how we think about home wastewater. Instead of "flush it and forget it", we can start to see wastewater as an asset that can be recycled, providing wildlife with food and people with attractive flowerbeds that never have to be watered or fertilized.

Plant/rock filter for zero discharge

by Becky Gillette

In March of 1992, my husband, Roger Danley, and I purchased a lot on Old Fort Bayou in Ocean Springs. We lived about 60 miles north of the coast in Hattiesburg, but Roger was hoping for a transfer to the Coast sometime in the future.

The lot is in Gulf Hills Subdivision, which doesn't have a centralized sewage system. So, prior to purchasing the lot, we called the health department to make sure it would qualify for a plant/rock wastewater treatment system. We were told the lot would qualify, but we didn't actually go ahead and apply for a permit at that time because we thought it might be years before we started building and a central sewer was being planned.

Five months later Roger was transferred to the Coast, so we went ahead with building plans. Imagine our dismay when we found out that state regulations had changed in July 1992. No part of a wastewater treatment system could be located within 100 feet of the water; there was no approved septic tank treatment system, including the plant/rock filter, that could be put on our lot.

Talk about stress. We had nowhere to build and an expensive lot suitable for great bird watching and little else until years down the road when a centralized sewage system was finally installed. With neighbors all around me with septic tanks that had inadequate drain fields, it didn't seem fair that we wouldn't be allowed to build even though we would have a better system than anyone in the neighborhood. Yet there was a valid reason for the state passing more stringent requirements for home wastewater treatment systems. Experience had shown that most existing home wastewater treatment plants, including mechanical treatment plants costing \$5,000 and more, were failing to adequately treat wastewater in waterfront areas.

Knowing our keen interest in the plant/rock filters, the health department was willing to work with us to come up with an alternative. We received a permit for an experimental zero-discharge plant/rock filter designed with the help of artificial marshland treatment systems expert Dr. Bill C. Wolverson.

The idea behind the zero-discharge system was that no water would be discharged from our property within 100 feet of the water. To accomplish that, we first doubled the normal size of the plant/rock filter from one 300-square-foot bed to two 300-square-foot beds. The beds were placed as far from the water as possible. Discharge from the second bed was directed into a 150-square-foot sand filter.

In order to minimize the amount of water that would need to be treated, we installed low-flow toilets that use only 1.6 gallons per flush, and low-flow faucet fixtures. We didn't install a dishwasher--too wasteful of energy anyhow--or a garbage disposal. We estimated water savings of about 33 percent from what is average for a three-bedroom home. The average is 360 gallons per day, while we probably use about 240 gallons per day.

Although we received the permit for the first zero-discharge

system in Mississippi. Tennessee Valley Authority reports cite examples of zero-discharge systems. I also knew of one zero-discharge system located in my area at the home of John and Donna Ford, who live near Vancleave. Their plant/rock filter is only 100 square feet, yet absorbs all of the black water from his home. Gray water from the washing machine is routed elsewhere. The Fords' filter is planted with river cane that can grow to a height of about ten feet in the summer. Ford said the filter became zero discharge after the first season of growth.

Our first season the rock/plant filter didn't absorb all the water used in the house. Several factors were at work. First, ideally we would have lined only the first bed, and left the second bed unlined to allow percolation into the soil. But because of our proximity to the water, we were required us to line both beds.

Secondly, our water use is higher than ideal because we have young children who prefer baths over showers, and we have an old washing machine that uses a lot of water.

Other factors that have influenced the discharge include an abnormally wet year with rainfall totals far above normal, and plant coverage of only about 50 percent in the beds. It's difficult to put plants in the one-foot spacing that is ideal because digging in the gravel is difficult; the gravel tends to fall back in the hole as you're digging it. Our plants were spaced about two feet apart, and we also experimented with a number of smaller plants that are now being eliminated in favor of the taller plants with dense growth habits such as ginger lily and bananas.

Although the discharge from the sand filter was highly treated and contained no odor, we were committed to the zero-discharge concept, and didn't want any water leaving the area of our yard that was 100 feet from the water. Roger came up with a low-cost method to collect the water for re-use that we're using until the next growing season, when we expect the plants will grow enough to use up all the water.

Our installer, Harry Moreland of Petal, had given us a way to monitor the water level in the sand filter. It consisted of a three-foot section of 12-inch diameter pipe placed in the sand. Inside the 12-inch pipe was a section of 8-inch pipe with holes drilled in it. Gravel was placed between the two pieces of pipe. Excess water collected in the middle of the 8-inch pipe.

Roger bought an inexpensive automatic bilge pump from a boating supply store, and attached it to a 12-volt marine battery. When the water level gets high enough, the bilge pump comes on to pump the water up to flower beds or grass located next to the plant/rock beds. The treated wastewater (which, unlike our tap water, doesn't contain chlorine) is also used to water our outdoor potted plants. The battery needs to be recharged only about every three weeks, so the water recycling system doesn't take much time on our part to maintain.

In summer and fall the amount of discharge varied from one- to two-gallons per hour depending on water usage in the home. We even had a couple of hot, dry fall days when there was no discharge, which leads us to believe the system will absorb all the water

sometime next summer when there is a more complete plant cover in the filter. To my surprise, after most of the plants died back after a frost Dec. 31, 1993, the plant/rock system started absorbing more wastewater than before the frost. I believe that it's due to the very low tides that are normal for this time of year when north winds often drive most of the water out of the bayou near the house. When the bayou empties, water drains towards it lowering the water table, which lets the sand filter absorb more wastewater.

It's my belief that zero-discharge systems such as the one at my home are the most environmentally sound treatment option available. Yet Roger and I may be forced to disconnect ours in a year or so. Plans are in the works for a centralized sewer system for Gulf Hills. The sewer system would pump every drop of water used for the 450 homes in the area out about six miles to a regional wastewater treatment facility that uses, in part, an artificial marshland treatment system.

The cost to homeowners for the new sewage system is estimated to be \$3,600 per home just for installation of the system. Monthly treatment costs would be an additional cost. We're looking at \$100 per month sewer bills.

And, should a hurricane knock out power for a couple weeks, as has happened in the past, the sewage system won't work. Our plant/rock system, on the other hand, is all gravity flow and could still be used even during a power failure.

It seems very wasteful of energy to pump every drop of water used in this subdivision six miles when adequate treatment could be achieved here in the neighborhood with either individual home or cluster home artificial marshland wastewater treatment systems. But, I'm having little luck encouraging local authorities to consider this option even though currently it is projected that it will be at least two more years before the central sewer is installed. The arguments against the individual home systems is that there is not enough data yet to prove the effectiveness of the home systems, and that homeowners can't be trusted to properly maintain home systems.

It seems ironical to me that homeowners can be "trusted" to pay \$100 per month for sewage bills, but not to maintain a far less costly and more environmentally sound home system. When properly installed, the home systems need very little maintenance but, if officials felt it necessary, why couldn't an official from the utility district check each home system once per year? The cost would still be considerably less than going with regional treatment.

It also seems that we can't continue to squander energy by doing things like shipping wastewater long distances for treatment when the same objective can be achieved closer to home. The ideal future of wastewater treatment, in my opinion, is with these natural plant systems that purify water before it ever leaves the homesite. Individual home systems may very well be the wave of the future.

Mississippi Forestry Commission has Grants available for tree planting

The Mississippi Forestry Commission is currently accepting applications for tree planting grant funds through the National Resource Development/National Tree Planting Program.

Funds are available to state or local governments, non-profit groups and educational institutions for the purpose of contracting with small businesses to plant trees on land owned or controlled by state or local government. Projects are to be carried out during the fall through spring of 1994-95.

The program sponsored in cooperation with the Small Business Administration requires grant recipients to utilize small business contractors to plant the trees and are encouraged to allow more than one small business to perform the work. In addition, all tree purchases must be from small businesses.

Mississippi is eligible to receive \$179,556 in grant funds this year. Local applicants are eligible for up to \$15,000 in federal funds and are required to match the federal dollars with 45 percent of the total project cost. Local matching funds may be in the form of cash or in-kind services.

Proposals are due by March 11, 1994. To receive an application, contact Darlene Slater or Rick Olson at Mississippi Forestry Commission, 301 N. Lamar St., Suite 300, Jackson MS 39201-1402, (601)-359-1386.

Landscape seminar set March 5

March 5: Miss. State Univ. Landscape Seminar at Bost Extension Center. Speakers: Jerry Jackson, gardening for birds; Milo Burnham, composting; Gail Barton, establishing a water feature; Felder Rushing, garden maintenance. Perennial gardening discussion also on agenda. More info: Jim Perry, 325-3012.

Horn Island trip coming up!!!

April 30: MNPS field trip to Horn Island. Cost: \$25. MUST REGISTER BY MARCH 15 by sending a check to MNPS Sec./Treasurer Ron Weiland, Miss. Museum of Natural Science, 111 N. Jefferson St., Jackson MS 39201. After you register, we'll send more details. More info: call Bob Bruzsek at 799-2311. If you're planning on staying overnight, dorm rooms are available at the Marine Research Lab in Ocean Springs for \$10 per night. Call Becky Gillette at 872-3457 to reserve dorm room; pay for dorm rooms after you arrive. Must provide own bedding in dorm rooms, and share bathroom.

If you want to stay in a hotel room, be sure to reserve as early as possible as hotels can be scarce due to the growth of casino visitors. Number for hotel reservations in Harrison County: 1-800-945-4356. Hotels in east Biloxi will be closest. Number for

tourism information from Harrison County: 1-800-237-9495.

Sunday possibilities include visiting the Walter Anderson Museum of Art in Ocean Springs or the Gulf Islands National Seashore, Davis Bayou, Ocean Springs, which has naturalist walks on Sundays. There are also Blessing of the Fleet activities in Biloxi on Sunday.

Tombigbee field trip planned

April 16: MNPS field trip to Tombigbee National Forest. More info: Sidney McDaniel, 325-7570.

Field trip set at Holly Springs

A Saturday early in May: MNPS Field trip to Holly Springs National Forest in Tippah County. Danny Meeks will conduct the trip. More Info: Sidney McDaniel, 325-7570.

Botanical Gardens Tour Planned

May 21: Tour of the Botanical Garden of the South, Sessums. More info: Sidney McDaniel, 325-7570.

Medicinal Wild Plant Conference planned

June 3-5: Botanical Folklore and Medicinal Wild Plant Conference, Ocean Springs. Keynote speaker is noted national authority Dr. Jim McChesney, Research Institute of Pharmacological Science, Univ. of Miss., who serves on advisory council for Herb Research Foundation. Further details in next newsletter. If you want to participate as a speaker or want more info, call Becky Gillette, 872-3457. We need medicinal native plant articles for newsletter in April!!! Submit by April 5.

Thank you, Sherrie!!!

Special thanks to outgoing secretary/treasurer Sherrie Wiygul for the many hours spent keeping up with society finances, keeping the membership list and printing newsletter labels. She's done a great job!!! Pat her on the back the next time you see her.

RENEW NOW IF YOU WANT TO CONTINUE GETTING MNPS NEWSLETTER!!!

Check the label on your newsletter. Unless the label says 94, comp. (complimentary subscription to other plant societies, etc.) or life, then it is time to renew your membership to the MNPS. PLEASE RENEW NOW OR THIS WILL BE THE LAST ISSUE OF THE NEWSLETTER YOU WILL RECEIVE. Renew using form on page 11.

Want to serve plants? New pres. needed

It's time to elect a new board of directors. Currently, we haven't found anyone willing to serve as president. Vic Rudis has agreed to serve as interim president until a new president is found. If you have time to give to the cause of preserving and spreading appreciation of Miss. native plants, or have a nomination, please call Vic. Since the election is noncontested, we won't be sending out ballots--a waste of paper and stamps.

The following have agreed to serve for 1994-95:
Vice President, Bob Brzusek, Picayune
Secretary/Treasurer, Ron Weiland, 354-7303.
Editors, Becky Gillette & Roger Danley, Ocean Springs

Non-elective positions:

Past-President: Vic Rudis, Starkville, 324-0430
Education Chair: Felder Rushing, Jackson, 982-6541
Publicity Chair: Reesa Yarborough, Brandon, 824-0275
Trips Chair: Sidney McDaniel, MSU, 325-7570.

Wildflowers of Mississippi, softcover edition, is for sale by the MNPS at a cost of \$19.50 plus \$2.50 shipping (add \$1 for 1st class). T-shirts and books can be purchased from Vic Rudis, P.O. Box 2151, Starkville MS 39759.

WE NEED ARTICLES and b&w photos for the newsletter on all kinds of issues of interest to members. Need medicinal native plant articles for next newsletter, deadline April 5. Please double-space manuscripts, and (optional) submit copy on diskette if possible (Word Perfect on 3.5" disk preferred, but can translate most other word processing programs). Send to: Editors, MNPS, 6104 Olvida Circle, Ocean Springs MS 39564. Phone: 872-3457.

Membership Application or Renewal

_____ New member _____ Renewal
_____ Student, \$5.00
_____ Individual or family, \$7.50
_____ Sustaining, \$10.00
_____ Contributing, \$25
_____ Life, \$125.00

All members receive MNPS Quarterly. Life members also receive Wildflowers of Mississippi. Return form and check to: Miss. Native Plant Society, P.O. Box 2151, Starkville MS 39759. Include the following info with your payment:

Name _____ Address _____
_____ Telephone: _____
_____ If Mississippi, county _____

Mississippi Native Plant Society

The purpose of the Native Plant Society is to further knowledge about the native and naturalized plant species of Mississippi, and to encourage an attitude of respect and appreciation for these species.

Programs include field trips to locations throughout state and lectures, seminars and slide shows by native plant experts, ecologists, landscape experts, knowledgeable amateurs and gardeners.

The goal of the society is to gather and disseminate knowledge about the native and naturalized plant species and their habitats in Mississippi. The society works for the preservation of these species and conservation of their habitats. We inform the public about these species and habitats, including their propagation, importance, ecology and need for protection, and encourage the propagation and use of native plants and habitats in designing residential, commercial and public landscapes.

We also facilitate the study of state flora and monitor nature preserves through newsletter announcements, networking and awarding small research and education grant. Other projects include plant and seed exchanges, maintaining displays for public education and plant rescues in areas about to be developed.

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