



Hawaii Backyard Conservation

Ideas for every homeowner



What's In This Book

In this publication, you will find practices you can use to conserve and improve natural resources in your backyard. These handy tips can help to protect the environment, help wildlife, and in many cases, make the area more attractive and enjoyable. Most backyard conservation practices are easy to put in place. Ideas are provided here, but for more information or for help in developing your backyard plan, you may want to consult a local landscaper, garden club, or any of the organizations listed on the back of this booklet.



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Beneficial Insects

Attracting beneficial insects to your yard.

Butterflies, damselflies, and bees will help to pollinate flowers naturally. There are two native butterflies in Hawaii, the Kamehameha butterfly resembles the monarch, but has more red than orange and prominent black markings especially under the wings. This beautiful insect can usually be found at higher elevations but has been seen even in downtown Honolulu. The Blackburn butterfly is a luminous blue-green and can be found at most elevations. Native crickets and spiders eat harmful bugs, minimizing the need for chemical pesticides.



Amy Tsuneyoshi, HBWS



Amy Tsuneyoshi, HBWS



Amy Tsuneyoshi, HBWS

Native nectar plants for butterflies:

Koa, *Acacia koa*;
 'A'ali'i, *Dodonaea viscosa*;
 Native Hibiscus, Ma'o hau hele, *Hibiscus brackenridgei* (E);
 Kokio ke'oke'o, *H. arnottianus* (E), and *H. waimea* (E);
 Koki'o, *Hibiscus kokio* (R);
 Ko'oko'olau, *Bidens spp.*
 (19 endemic & 4 naturalized species)

Native plants for caterpillars:

Māmaki, *Pipturus albidus*;
 Koa, *Acacia koa*;
 'Ena'ena, *Gnaphalium sandwicense*



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Shari Lau



Amy Tsuneyoshi, HBWS



Composting

Turn household vegetative waste into fertilizer.



All organic matter eventually decomposes. Composting speeds the process by providing an ideal environment for bacteria and other decomposing micro-organisms. The final product, compost, looks and feels like fertile garden soil. This dark, crumbly, earthy-smelling stuff works wonders on all kinds of soil and provides vital nutrients to help plants grow and look better. Decomposing micro-organisms need four key elements to thrive: nitrogen, carbon, moisture, and oxygen. For best results, mix materials high in nitrogen (such as clover and fresh grass clippings) and those high in carbon (such as dried leaves and twigs). Moisture is provided by rain, but you may need to water the pile to keep it damp. Be careful not to saturate the pile, use a cover to prevent saturation. Oxygen is supplied by turning or mixing the pile. More turning yields faster decomposition.

Getting started

Many materials can be added to a compost pile, including leaves, grass clippings, straw, woody brush, vegetable and fruit scraps, coffee grounds, sawdust (excluding sawdust from treated lumber), and shredded paper. Avoid using meat scraps that attract animals, and dog or cat manure which can carry disease. Composting can be as simple or as involved as you would like, and depends on how much yard waste you have, how fast you want results, and the effort you're willing to invest.

Cold composting

With this method, you can add grass clippings and dry leaves on the ground or in a bin. It requires no maintenance, but you'll have to wait several months for the pile to decompose. This works well if you're short on time or have little yard waste. Keep weeds and diseased plants out of the mix. Add yard waste as it accumulates.

Hot composting

This requires more work, but with a few minutes a day and the right ingredients you can have finished compost in a few weeks. Hot piles must be built all at once in a four to five foot cube and turned regularly. As decomposition occurs, the pile will shrink. A three foot cube is needed to maintain necessary heat. Hot piles can reach 110 to 160 degrees Fahrenheit, killing most weed seeds and plant diseases. On a level site, lay down bricks or prunings to promote air circulation. Spread several inches of the high-carbon material, then mix high-carbon and high-nitrogen material together. Water periodically. Punch holes in the sides of the pile for aeration. The pile will heat up and then begin to cool. Start turning when the pile's temperature begins to drop. Move materials from the center to the outside and vice versa. Turn every day or two and you should get compost in less than four weeks. Turning every other week will give compost in one to three months. Finished compost will smell sweet and be cool and crumbly to the touch.



Additional Resources

www.ctahr.hawaii.edu/ctahr2001/PIO/FreePubs.asp
www.opala.org/recycling_at_home/greencycling.html
www.recyclehawaii.org

Managing Nutrients

Apply only those nutrients the plants can use.

Nutrients are essential for good plant growth, but over applying nutrients is not good for plants or for the environment. Excess nutrients leach through the soil and end up in ground water, or run off into storm drains and enter our streams and bays. The three primary plant nutrients are nitrogen (N), phosphorus (P), and potassium (K). In Hawaii, nitrogen and phosphorus have caused problems with excessive aquatic plant growth.

Remember to consider native plants or others with low fertilizer needs.

Soil test is key

The key to good nutrient management in your backyard is a reliable soil test. Without a soil test, you could be applying too much, too little, or the wrong nutrients. You'll want a separate soil test for your lawn and for your garden.



In general, native plants such as 'Ilima do well without supplemental fertilizer applications.

Commercial soil test kits available are not calibrated to give accurate recommendations for Hawaii. Contact your local Cooperative Extension Service (CES) office for information on how to take and submit soil samples to the University of Hawaii Agricultural Diagnostic Service Center (ADSC). Consult with your local cooperative extension agent to help you understand soil test results, fertilizer recommendations, and how to correctly calibrate your spreader.

Organic or conventional fertilizers usually provide primary plant nutrients (N-P-K), but plants require at least 10 other nutrients (called micronutrients). You can get a plant tissue test to determine if your plants need micronutrients.

Apply only the nutrients needed according to soil test results. Never exceed the recommended rates and timing.

Fertilizing lawns

- To avoid excess nitrogen in Hawaii's waters, use slow-release nitrogen fertilizers. Consider using compost to enhance or replace fertilizers.
- Leave grass clippings on the lawn for fertilizer.
- Avoid using fertilizers that contain weed killer or insecticide. These chemicals should be used only when other more environmentally-friendly pest control options fail. Use them only on affected areas.
- Be careful not to spread fertilizer on sidewalks and driveways.
- Be sure to calibrate your spreader correctly.

Fertilizing gardens

- Use compost to enhance or replace fertilizers.
- Choose a level site, or terrace the garden, to avoid runoff and erosion.
- Place fertilizer near plants rather than broadcast it over the entire garden.
- Add organic matter to the soil by using manures and organic fertilizers at a conservative rate.

Agricultural Diagnostic Service Center
<http://www2.ctahr.hawaii.edu/adsc/>

Testing Your Soil: Why and How to Take a Soil-Test Sample
www.ctahr.hawaii.edu/ctahr2001/PIO/FreePubs.asp

Additional
Resources



Managing Pests

Early detection of pests means healthy environment.

Good planning can put you a step ahead of unwanted insects, weeds, and diseases. Healthy, vigorous plants minimize pest damage. Regular monitoring of your lawn or garden is the best way to stay on top of potential plant health and pest problems. If you see minimal damage, it is often easiest to just tolerate it and continue monitoring. If pests begin to cause serious damage, there are a number of management methods.

Preventing pests

- Plant disease and pest-resistant or tolerant species.
- Clean up litter and remove weeds before they go to seed.
- Don't over water or over fertilize your plants. It can make them vulnerable to insects and disease.

Physical pest control

- Remove insects by hand.
- Wash pests away using a water spray nozzle.
- Set traps where possible.
- Make physical barriers around plants, such as a wire mesh fence partially sunk into the ground for rabbits, aluminum foil wrapped around vegetable plants for cutworms, and solid barriers to prevent weeds from invading flower beds or vegetable gardens.

Beneficial insects

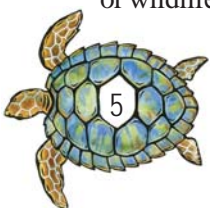
Having the right insects in your garden or backyard can keep pests and weeds in check. Beneficial insects, such as ladybugs, assassin bugs, and praying mantises, prey on insects that can harm your plants. The following insects are encouraged for your backyard as they can help control pests:

- Ladybugs and lacewing larvae for controlling aphids and a wide variety of other insects.
- Preying mantises for controlling many insects.
- Predatory mites for controlling pest mites, thrips, and many others.
- Ground beetles feed primarily on caterpillars that attack trees and shrubs.

Chemical controls

If the methods listed above fail to solve your pest problem, use chemicals of low toxicity and rapid decomposition. Always read the label, follow directions, wear protective clothing, and spot-spray. Some of these chemicals are:

- Pesticidal soaps for aphids, scale crawlers, whiteflies, and thrips.
- Insecticidal dusts for aphids, beetles, fleas, ticks, ants, and crickets.
- Horticultural oils for aphids, mites, leafhoppers, mealybugs, scales, plant lice, and mosquito larvae.
- Biologically based pesticides such as *Bacillus thuringiensis* (B+) or spinosad for control of caterpillars
- Botanicals for leafminers, fleas, and ticks.
- Liquid formulations and products for control of insects, mites, diseases, nematodes, and weeds.
- Before you apply pesticides, make sure that they will not harm beneficial insects or be hazardous to humans, pets, or wildlife.



Additional Resources

www2.ctahr.hawaii.edu/extout/extout.asp
www.hawaii.gov/health/environmental/vector/index.html
www.recyclehawaii.org/alt1.htm

Mosquitos, as we all know are a maddening nuisance. They can also spread some potentially deadly diseases to both humans and birds. The best defense is to control them around your house by minimizing areas where standing water accumulates such as leaf litter, bromeliads, old tires, plugged rain gutters, etc.

Mulching

Mulching cools, protects, and enriches the soil.

Mulching involves placing a layer of material around plants. As mulch decomposes, it adds organic matter to the soil. This provides important nutrients for plants and an ideal environment for earthworms and other organisms that help enrich the soil.

Mulching can recycle yard wastes and improve your soil. Mulch protects soil from erosion, prevents weed growth, conserves soil moisture, stabilizes soil temperature, reduces compaction, and keeps any fruit or vegetable that touches the ground clean and dry.

Mulch Material

The best place to look for mulch material is in your yard. Grass clippings and leaves work well for mulching if they are dry and weed free. Avoid adding clippings to your vegetable garden from lawns that have been treated with weed killer within the last two mowings. Compost makes an excellent organic mulch material. It adds nutrients to the soil and has a natural appearance. Wood chips and bark work well around trees and shrubs and make attractive walkways.

Applying Mulch

Insulate the root zone and lower evaporation rates if you liberally apply mulch. Be careful not to smother the plants. As the mulch breaks down, add more material to the top throughout the growing season. After harvest, work the mulch into the soil to integrate the organic matter, or leave it on the surface to decay naturally and be carried into the soil by earthworms. Apply mulch when plants are established and soil is warm. First, water your garden well. Then place a layer of mulch around the plants. As a rule of thumb, mulch should be kept five inches away from the trunks of shrubs and ten inches away from the trunks of mature trees. Thickness of the mulch layer varies for each material, listed below are common materials:

MATERIAL	LAYER/DEPTH	LIFE SPAN OF MATERIAL	NOTES
burlap	1 layer	6 months	
chipper (bark/leaves)	3-4 inches	6-9 months	
cinder/gravel	3-4 inches	1-2 years	crushed coral can increase soil pH
compost	3-4 inches	6-8 months	best used as soil conditioner
lawn clipping	1-2 inches	1-3 months	dry for a day before using
macadamia husk	3-4 inches	8-10 months	
newspaper	3-6 sheets	2-6 months	avoid glossy, color prints
plastic film	1 layer	10-36 months	check product label for lifespan
saw dust	1-2 inches	4-6 months	possible fire hazard
woven weed barrier	1 layer	3-5 years	check product label
wood chips	3-4 inches	6-9 months	



Free mulch is available to the public on Oahu, visit:
www.opala.org

Additional Resources



Native Plants

Providing wildlife habitat with trees, shrubs, and ground cover.

Our environment is your backyard

About 1500 years ago, before humans altered the lowland forests, your backyard was the habitat for native birds and the native plants that grew there served as their source of food and shelter.

Today there are 317 threatened and endangered species in the State of Hawaii, of which 273 are plants. Most of these bird and plant survivors now grow in the wild only in very remote areas. Almost 90% of the plants commonly grown in our urban and suburban areas of the islands are *not native*. **You can help reverse this trend.** When you grow native trees, shrubs and other plants in your backyard above 4000 feet elevation, you help create habitat and provide food and shelter for Hawaii's native forest birds. Planting native trees and shrubs at any elevation provides habitat to Hawaii's unique native pollinating insects.

Many of native Hawaiian plants are beautiful, easy to grow and available to purchase through local nurseries. **If unique is what you seek, endemic plants are native to Hawaii and found nowhere else in the world!** Some endangered species such as Hawaii's State Flower, *Hibiscus brackenridgei*, are available at local nurseries and can be easily grown in the home garden. Add them to your garden to help preserve Hawaii's biological heritage. **Never harvest these plants from the wild ~ it's against the law.** Also, do not plant cultivated plants in the wild unless it is an approved restoration project. Weeds, pests, and diseases can be unintentionally spread to pristine areas through contaminated plant materials.

‘Ākia

naupaka

pohinahina

‘Ūlei



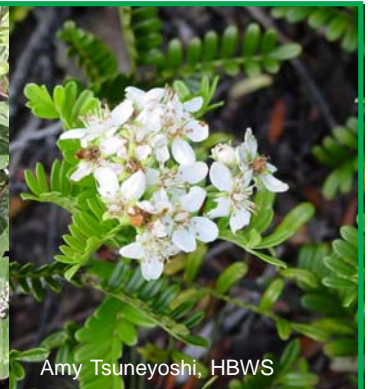
Jolene Lau, NRCS



Jolene Lau, NRCS



Jolene Lau, NRCS



Amy Tsuneyoshi, HBWS

Plant	Habitat	Growth Rate	Height	Spread	Elevation
‘Ākia	Tolerates salt, wind, drought	Rapid	1-3 feet	2-10 feet	0-4,206'
Naupaka	Tolerates salt and drought	Moderate	3-10 feet	2-5 feet	0-1,000'
Pohinahina	Thrives in sandy soils	Rapid	0.5-4 feet	3-6 feet	0-45'
‘Ūlei	Thrives in various habitats	Slow	4-10 feet	4-6 feet	0-6,000'



Additional Resources

www2.bishopmuseum.org/ethnobotanydb/index.asp
www.dofaw.net
www.hawaii.gov/dlnr/dar/index.html
www.state.hi.us/health/oeqc/garden/eioegpic.htm

Native Plants



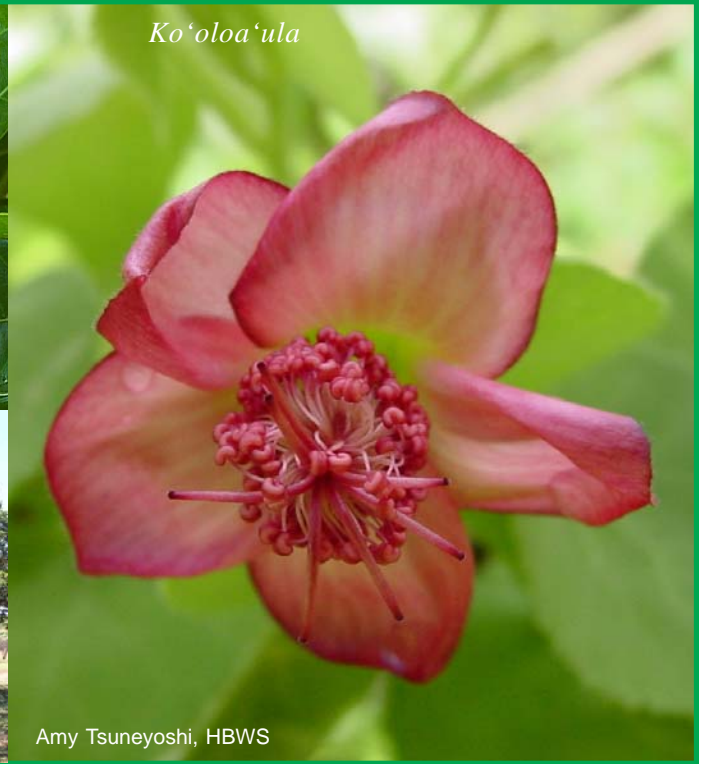
'Ōhelo

Jolene Lau, NRCS



Nānū

Amy Tsuneyoshi, HBWS



Ko'oloa'ula

Amy Tsuneyoshi, HBWS



pua kala

Amy Tsuneyoshi, HBWS



wiliwili

Glenn Sakamoto, NRCS

Type	Plant Name	Habitat	Growth Rate	Height	Spread	Elevation	Rain	
Groundcover	'Ae'ae	Thrives in moisture	Rapid	2-4"	1-4'			
	'Ākulikuli	Tolerates salt, wind, drought	Moderate	2-5'	1-2'	540-2400'	Light	
	'Āwikiwiki	Thrives in mesic forests	Moderate			540-2400'	Moderate	
	Bonamia menziesii	Thrives in dry area	Moderate			450-1875'	Light	
	Hinahina	Tolerates salt, wind, drought	Moderate	2-6"	2-4'	Coastal	Moderate	
	'Ilie'e	Tolerates salt, wind, drought	Moderate	6-18"	3-6'		Light	
	'Ilima papa	Tolerates salt, wind, drought	Moderate	2-8"	3-4'	0-5940'	24-45"	
	Kupukupu	Tolerates salt, wind, drought	Slow	2-3'	1-4'		Light	
	Nanea	Tolerates salt, wind, drought	Rapid	6-8"	4-8'	0-360'	Moderate	
	Nehe	Thrives in moderate moisture	Rapid	1-3'	2-5'		Moderate	
	'Ōhelo kai	Tolerates salt, wind, drought	Moderate	1-3'	2-5'		Light	
	Pa'uohi'iaka	Tolerates salt, wind, drought	Rapid	2-4'	3-5'	0-90'	20-45"	
	Pili grass	Tolerates salt, wind, drought	Moderate	2-4'	1-2'	0-1500'	15-38"	
	Hedges	'A'ali'i	Thrives in dry & coastal area	Moderate	3-10'	8'	0-7000'	20+"
		Alahe'e	Thrives in dry to mesic forest	Moderate	0-15'	3-5'	0-3000'	40+"
		Hinahina 'Ewa	Thrives in moderately dry area	Moderate	4-8'	3-5'		Moderate
		Ko'oloa'ula	Tolerates drought & dry area	Moderate	3-6'	2-4'	600-1560'	Light
Kulu'i		Thrives in dry areas	Moderate	3-6'	8'	0-6000'	20+"	
Nānū		Thrives in dry forests	Moderate			1050-1580'	Light	
Pāpala		Thrives in heavy moisture	Moderate	4-15'	3-5'	915-1830'	Light	
Shrubs		Kokio ke'oke'o	Thrives in mesic to wet forest	Slow	6-10'	5-10'	0-2500'	Light
		Ko'oko'olau	Thrives in a variety of areas	Rapid	.5-10'		900-3600'	Light
		Maiapilo	Thrives in moderately dry area	Rapid	3-5'	3-5'	0-300'	Moderate
	Ma'o	Tolerates salt, wind, drought	Moderate	5'	8'	0-1000'		
	'Ūlei	Thrives in a variety of areas	Slow	4-10'	4-6'	0-6000'		
Trees	Koa	Thrives in a variety of areas	Slow	0-75'	10-40'			
	Lama	Thrives in dry to mesic forest	Slow	15-40'				
	Naio	Thrives in a variety of areas	Slow	6-30'	10'			
	'Ōhi'a	Thrives in a variety of areas	Slow	25-100'	25'			
	Loulu	Tolerates salt, wind, drought	Slow	25'	15'			



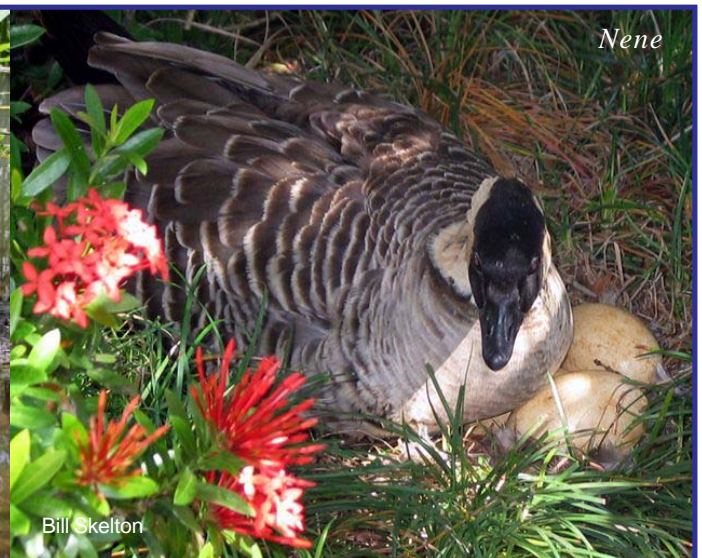
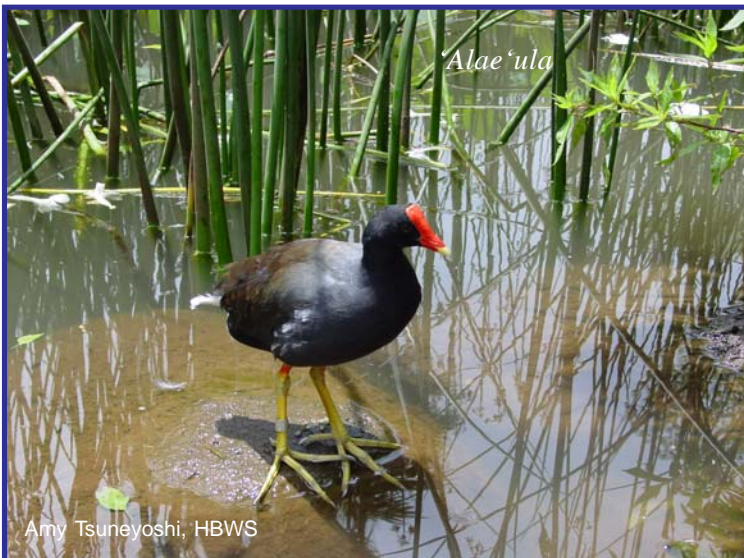
River/Stream/Wetland

Suggestions if you live near a Stream or Wetland.



Healthy rivers, streams, and wetlands provide habitat for wildlife and aesthetic value. Wetlands filter excess nutrients, chemicals, and sediment, and provide habitat for a host of native birds, many of which are threatened or endangered. If you're fortunate enough to live near a stream or wetland, you can personally help protect many of Hawaii's endangered aquatic animals and water birds. Here's how:

- Grow native plants suited to your area, especially adjacent to and along streams and wetlands to provide partial shade.
 - Prevent toxic chemicals such as those used in lawn care and landscaping from entering wetlands and water sources.
 - Don't dump trash in streams or wetlands. Stop other people who do.
 - Avoid entering streams during the breeding season.
- Don't build too closely to streams.
 - Keep rat populations under control. It's healthier for your family plus rats eat bird eggs.
 - Keep your cats indoors and your dogs leashed. These household pets can kill a nest of young chicks within minutes.
 - Don't release domestic mallards into streams and wetland areas. They compete with native birds for food and habitat.
 - Don't feed any wild birds, it can increase their risk for disease.
 - Don't release exotic fish, invertebrates (snails, crayfish, shrimp), or aquatic plants into streams, rivers, and wetlands. It's against the law.
 - Call the Department of Health's Vector Control to remove mongoose and feral animals if they are seen in your yard.



Additional Resources

www.abcbirds.org/cats/states/hawaii_intro.htm
www.ducks.org
www.hawaii.gov/health/environmental/vector/index.html
www.state.hi.us/health/oeqc/garden/eioegsrc.htm

Sheet Mulch Garden

What is it?

A sheet mulch garden is constructed with little or no soil. It is a layered system of organic materials that composts as time passes. A sheet mulch garden does not require tilling of the soil and is a method of using organic wastes to grow food.

Background

A great way to recycle yard waste and other biodegradables is to build a recycled garden. This idea was originated in England by Ruth Stout many years ago and is still a practical viable way to grow food using little or no soil and layered organic materials. All it takes is a creation of a border using logs, rocks or old lumber and collection of materials for layering in the interior.

Why should we make a sheet mulch garden?

This method helps to recycle organic wastes, reduces soil erosion, increases soil moisture, and reduces waste disposal in our landfills. A sheet mulch garden also creates new soil by composting as we garden. This helps us to grow our own food and become more self sufficient. It turns garbage into gold and is a lot of fun for the family.

How can we make a sheet mulch garden?

It is possible to construct this type of garden on rock, cinder, grass, concrete, or even very hard soil that seems impossible to dig up. You will want to start collecting card board and paper, saving your lawn trimmings, and composting your organic waste materials. You may also consider collecting hedge and plant trimmings, as well as composting manure. You will then need to layer these materials, putting the heavier materials at the bottom and lighter materials at the top.

A six to eight inch bed is recommended as a minimum.. Macadamia nut husks and shells, coffee parchment, monkey pod leaves and shredded green waste from landscaping maintenance have all been used to build these gardens in Hawaii. In addition using composted manure and or small amounts fertilizer between each layer helps to provide plant nutrients and nitrogen.

After the bed is made small pockets can be opened up in the material and potting soil can be added to accommodate seedlings of tomato, pepper, eggplant or whatever you have on hand. For direct seeding a trowel can be used to place a 2" to 3" deep "row" of soil or potting mix on the surface of the bed. Lettuce, herb or cabbage seeds can be sprinkled in and covered. Root crops are not recommended for a new mulch garden.

Over time, organic materials, composted manure and fertilizer are continuously added to the garden to keep the bed level and to feed the composting process. Earthworms will appear in most gardens within a few months. These gardens have been successfully constructed on hard soils, abandoned lots and yes, even asphalt and lava flows. Water and care for the recycled garden, as you would a regular garden.



Steve Skipper from the Big Island Resource Conservation and Development Council teaches students how to build and care for a sheet mulch garden in Waimea.



Storm Water (continued on next page)



Storm Drain Stenciling Project

Storm Water Best Management Practices Start at Home

Everyone lives in a watershed. An “Ahupua`a” is the Hawaiian word that comes closest to meaning watershed. The Hawaiians were masters of land and resource management through their concept of the Ahupua`a land division- a division that starts at the source (top of the mountain or mauka) and ends at the sea or makai. The Ahupua`a limit is the reef. The near shore waters were an important food source. Some ahupua`a principles that may be transferred to watershed planning and management include access to a complete resource base, reverence for water, respect for all living things, coordination and cooperation, intergenerational learning, `ohana among people, and the connection between people and the land.

Linking the Storm Drain System, Urban Environment, Streams, and Ocean

Making the Connection Between Yards, Streets, Storm Drains, Streams, and the Ocean. Storm water runoff is the rain that flows to streets, streams and the ocean. As land is developed, much of the surface is paved or roofed, creating more runoff potential. Runoff can affect the quantity and quality of water that must be handled somewhere downstream. The runoff carries with it whatever can be dislodged from the various sites, such as soil, leaves, pesticides, fertilizers, oil, gasoline, and any other materials present on the surface. The storm drains are a system of underground pipes that have surface drains or inlets designed to gather storm water. Many people think that storm water is treated at wastewater treatment plants just like water from sanitary sewers (e.g. sinks, toilets, and baths). In Honolulu, storm water does not go to wastewater treatment plants.

Start at Home

Many simple yet effective methods can be used to help reduce individual runoff. These are called Best Management Practices or BMPs.

Some storm water BMPs can be implemented when first planning and building the home and designing the landscape. Others can be incorporated into day-to-day activities. These BMPs may seem rather simple or small, but the cumulative effect throughout an entire watershed can significantly contribute to improved storm water management.

Planning and Landscaping Best Management Practices

- Consider alternatives to concrete or asphalt paved surfaces. If you have a choice, consider more porous surfaces such as brick, gravel, wood chips, stone slab, or geo-textile materials. If areas must be paved, keep it to a minimum and direct runoff onto grassy areas, not onto areas that drain to storm sewers.
- Mulch and plant exposed soil as soon as possible. Use sediment barriers when necessary.
- Plant buffer strips of natural vegetation and woody plants to filter and slow runoff alongside waterways.



Additional Resources

www.cleanwaterhonolulu.com
www.hawaii.gov/dot/highways/index.htm
www.opala.org

Best Management Practices

Working Together to Protect Our Waters for Life

Day to day best management practices:

- Keep sidewalks, curbs and gutters clean. Leaves and lawn clippings are a source of phosphorus.
- Mulch grass clippings and leave these on the lawn for natural fertility or use the clippings for composting.
- Avoid excess watering and overuse of pesticides and fertilizers – use only the amount needed and apply only when necessary.
- Store oil, paint, gasoline, antifreeze, and other automotive products properly, under cover. Keep these substances tightly sealed. Dispose of batteries and tires properly.
- Clean up oil or other vehicle fluid drippings. Do not store used vehicle parts on areas that drain to the storm sewer.
- Cleanup hazardous material spills properly and don't wash waste into the storm sewer.
- Pick up pet waste.
- Wash vehicles at a commercial car wash or on a non-paved surface to avoid drains to the storm sewer.



Adopt-A-Highway Project

Be a Part of the Solution

The City and County of Honolulu and the Hawaii State Department of Transportation, working under Federal Clean Water Act Guidelines, has a number of public education programs that focus on community involvement and targeted enforcement to eliminate or reduce illegal discharge practices. Existing projects such as the storm drain stenciling, Adopt-A-Stream Workshops, World Water Monitoring Day in October, Adopt-A-Block, and Adopt-A-Highway cleanup and monitoring programs, provide opportunities to train an interested and committed audience.

Report It

Discharging pollutants to the storm drain system is against the law. Violations can result in fines of up to \$25,000 per violation, per day. As a resident, you can make a difference, both on the job and in your community. When you're at home, share your knowledge with neighbors and family. As you drive to work, be aware of any illegal discharges. And, if you do see an illegal discharge, report it.

Hawaii State Department of Transportation: (808) 587-2160

City and County of Honolulu Environmental Concern Line: (808) 692-5656

For information on printed materials; schedule a presentation, training session, and City display; participate in volunteer programs, information about the bulky item Opala Nui islandwide schedule changes, refuse collection, recycling, household hazardous waste, composting and other disposal services, report illegal dumping, get information on Down the Drain Do's and Don'ts for business operations, including the pretreatment program information and more.

References:

City and County of Honolulu Department of Environmental Services. *Tips To Help Protect Our Waters ... For Life.*

Maryland Department of the Environment

University of Wisconsin Extension. *Cleaning Up Storm Water Runoff.*



Terracing



Terracing makes gardening possible on slopes.

In your Backyard

Terraces can break your backyard into several mini gardens. On steep slopes, terracing can make planting a garden feasible. Terraces prevent erosion by shortening the long slope into a series of shorter, more level steps. This allows heavy rains to soak in, rather than run off and cause soil erosion.

Materials for terraces

Building terraces is like building a staircase. The material you use to make the face of the stair may be bricks, rocks, concrete blocks, or similar materials.

Height of walls

The steepness of the slope often dictates wall height. Make the terraces in your yard high enough so the land area between them is fairly level. Be sure the terrace material is strong enough and anchored well enough to stay in place through heavy rains. Large projects, such as retaining walls, may require a professional design and specialized assistance and equipment. Be sure to check local building codes regarding the installation of high walls and it is good practice to work safely.

Consider erosion control

Heavy rains can cause erosion between terraces, and create small gullies if water concentrates as it goes over a terrace. To help prevent erosion, add mulch or other good ground cover on land between terraces.



Tree Planting

Trees add beauty, shade, and so much more.

In your Backyard

Trees can reduce your cooling costs, help clean the air, add beauty and color, provide shelter from the wind and the sun, add value to your home, and provide habitat.

Choosing a tree

Choose a tree that will provide enjoyment for you and fits your landscape. Take advantage of references on gardening in local libraries, universities, arboretums, and parks where trees are identified, and from native plant and gardening clubs and nurseries. Before you buy, you can find out if a tree is appropriate for your area, how big it will get, how long it will live, and the proper planting instructions and care for that species.



koa tree

Select native trees because:

1. They will live longer.
2. They are more tolerant to local weather and soil conditions.
3. They will enhance the natural biodiversity in your neighborhood.
4. They are more beneficial to wildlife than non-native trees.
5. Non-native trees will invade other areas and crowd out native plants, harming the ecosystem.

Planting a tree

A properly planted and maintained tree will grow much faster and live much longer than one that is incorrectly planted. Trees can be planted almost any time of the year as long as the soil is prepared properly for root growth. Here are a few suggestions when planting a tree:

1. Dig a hole twice as wide as the root ball. Roughen the sides and bottom of the hole with a pick or shovel so that roots can penetrate the soil.
2. Gently separate circling roots on the root ball. Shorten exceptionally long roots, and guide the shortened roots downward and outward. Root tips die quickly when exposed to light and air, so don't waste time.
3. Place the root ball in the hole (allow adequate distance from fences, poles, slabs, and property lines) and lightly tap the soil to collapse air pockets or add water to help settle the soil.
4. Water thoroughly after planting and use mulch around the tree.

www.arbodayhawaii.org
www.nrcs.usda.gov/feature/backyard/TreePtg.html
www.state.hi.us/dlnr/dofaw/kaulunani/index.htm

**Additional
Resources**



Xeriscaping



The Halawa Xeriscape Garden has plant samples on display.

Xeriscaping is a systematic concept for saving water in landscaped areas. This practice combines irrigation techniques and using drought-tolerant plants and grasses. Techniques might include automatic timers, moisture sensors, rain shutdown devices, and low output sprinkler heads, emitters, or drip lines.

Suggested tips

- Create your Xeriscape in phases to allow for budgeting and timing.
- Limit turf areas and select plant materials that are less thirsty.
- Use efficient irrigation such as low volume drip, spray, or bubbler emitters.
- Apply organic soil amendments before installing irrigation systems to allow for better absorption of water and periodically add organic matter to the soil.
- Apply mulch to minimize evaporation, reduce weed growth, and slow down erosion.
- Know your microclimate areas and strategically place plants that are affected by moisture, sun, shade, and heat. Group plants according to watering requirements.
- Regular maintenance such as pruning, weeding, proper fertilization, pest control, and irrigation system adjustments further add to your water savings.



Additional Resources

www.boardofwatersupply.com
www.dofaw.net
www.kaulunani.org

Water Conservation

Drip irrigation and other practices can save water & money.

In your Backyard

If you rely on watering to make your lawn grow and your garden productive, consider a more efficient system. There are several ways to improve the use of water.

Watering to save energy

Whenever practical, water in the early morning. In arid areas, it's okay to water in the evenings and at night. You'll lose less water to evaporation than if you watered in the middle of the day, and the plants are less stressed and can take up the water more efficiently.

Mulch (refer to page 6) or fiber cloth preserves soil moisture. You can find supplies and information at a nursery or hardware store. Also, consider planting native species and trees (refer to page 7 & 8). They usually use little or no water beyond normal rainfall.

Drip irrigation benefits

A drip irrigation system (like the one pictured above) will provide water directly to the plant. You can control the flow to each plant. Drip irrigation ranges from inexpensive soaker hoses to elaborate computerized systems. There may be an up-front investment, but you'll use less water and have better water distribution. Garden or hardware stores will have the supplies you need. You may even want to engineer your own system from a garden hose. Be sure not to over apply fertilizer when using a drip system.

Watering lawns

The worst possible irrigation program is to water turf daily for 5-10 minutes. An efficient and economical way to irrigate a lawn is to apply water at the first signs of water stress. Research has shown that turf watered at the first signs of visual wilt used 33 percent less water. Watering for a slightly longer period promotes deeper root growth.

Hawaii turf grasses require no more than 3/10 inch of water per day in mid-summer and about 1/5 inch or less in the cool winter months. Select turf grass for its relative drought tolerance. In order of the most drought tolerant is bermudagrass, zoysiagrass, St. Augustinegrass, seashore paspalum, centipedegrass, carpetgrass, hilograss, and akiaki.



Drip tape is sold at most lawn/garden stores.

www.ctahr.hawaii.edu/ctahr2001/PIO/FreePubs.asp
www.epa.gov/owm/water-efficiency/index.htm
www.hawaii.gov/dbedt/ert/greenbusiness
www.hawaii.gov/health/oeqc/garden/index.html

Additional Resources



Weed Control

Avoid planting invasive species in Hawaii.

One of the major threats to Hawaii's native plants and wildlife is the spread of invasive alien species. These plants displace Hawaii's distinctive native flora because they have the ability to spread easily, reproduce quickly and grow fast, often shading out native plants that can't compete. The sad consequence is the loss of diverse native forests that support a large array of unique native plants and animals. Also, poor weed control can become a fire hazard.

Don't Plant a Pest

It is tempting to think that planting a beautiful tree or shrub in one's backyard, along the street, or in an agricultural lot is harmless. The fact is, many ornamental plants, which can be purchased at your local garden center or nursery can become terrible pests once they escape into the wild. Birds can eat their seeds and spread them into our native forests. Don't put these plants in your garden. If you have them now, consider removing them.

In fact, the ornamental plant trade accounts for the majority of invasive plant introductions to Hawaii. This single pathway of entry accounts for approximately 70% of all documented invasive plant species in Hawaii.

It only takes one

The multi-million dollar control effort against miconia (*Miconia calvescens*) was necessitated by the actions of only one or a few individuals who decided to introduce this invasive pest to Hawaii. This is why consciously landscaping our backyards with either natives or non-invasive alien plants is such an important part of conservation in Hawaii.

Be on the look out

You can have another important impact on the war against invasive alien pests.

- If you see invasive alien pests - report it to the **Pest Hotline** (808) 643-7378
- When hiking in our forests, brush your boots (to keep them free of unwanted seeds)
- When you travel, take care not to bring pests back to Hawaii or between islands.
- Remind others of these important guidelines.

Ornamentals NOT to use

Acacia's (Australian Acacia, Australian blackwood, gum Arabic tree, sweet acacia)
African tulip tree (*Spathodea campanulata*)
Australian tree fern *Sphaeropteris cooperi* (formerly *Cyathea cooperi*)
Cinnamomum spp. (camphor tree, cinnamon tree)
Fiddlewood (*Citharexylum spinosum*)
Guava's (*Psidium* spp.)
Lantana (*Lantana camara*, *Lantana montevidensis*)
Non-native fan palms (*Washingtonia* spp.)
Paper bark tree (*Melaleuca quinquenervia*)
Surinam cherry (*Eugenia uniflora*)
White ginger (*Hedychium coronarium*)



Lantana crowds out native plants.



Additional Resources

www.ctahr.hawaii.edu/ctahr2001/PIO/FreePubs.asp
www.hawaii.gov/dlnr/isw/iswhome.htm
www.hear.org/allis/cs/
www.state.hi.us/health/oeqc/garden/eioegsrc.htm

Wildlife Habitat

Protect Native Animals like the `elepaio.



All wildlife including butterflies, birds, and bats are vulnerable to many pesticides and other chemicals. So are children! Protect your family's health and Hawaii's wildlife by **minimizing chemical use**. If you use chemicals, always **follow label instructions**.

If You Love Birds... Don't Feed Them

There is no need to put out bird feeders in Hawaii. There is plenty of food available naturally for birds and feeding them corrupts their natural instincts. Purchased bird seed can contain weed seeds which may escape into the wild to become invasive plants. Large colonies of birds (such as mallards) pollute the water and transfer diseases to humans and other birds. Please don't feed the ducks! Purchased bird seed, bread and other food can also attract rats, mongoose and non-native birds that spread diseases.

Federally endangered, these active and feisty, wren-like flycatchers are found on Kauai, Oahu and Hawaii.

In addition, most of Hawaii's birds are not cavity nesters and don't use bird houses (non-native birds and rats use bird houses to look for a dry bed.) Native trees of Hawaii are favorites of birds of all types. These birds are susceptible to mosquito-borne diseases which affect them below 4000 feet elevation and also become predation by cats and rats. It is best not to encourage native forest birds in low elevation/urban environments.

If you live in an upland region there is a good chance that one of Hawaii's more common native forest birds has visited your yard. Follow the guidelines above and enjoy witnessing some of Hawaii's exceptional natural heritage.

In some instances, practices described in this book could attract unwanted wildlife, or more of a species than is desirable. If you have problems with any wildlife species, most nurseries or garden stores, and organizations listed in the "Where To Get Additional Assistance" section at the back of this book can provide information on preventing or controlling them. The government agencies listed can provide information on Federal and State regulations regarding protection of wildlife species. Equipped with the right information and tools, most people are able to solve their own problems and live in harmony with wildlife.

A Few Tips to Remember:

1. Follow instruction on labels for chemical pesticides.
2. Avoid overusing chemical products which leach into water.
3. Consider natural alternatives to chemical products.
4. Look for plants that attract beneficial insects.
5. Prevent mosquito growth in standing water.



www.dofaw.net
www.hawaii.gov/dlnr/consrvhi/silent/top10
www.hear.org
<http://mano.icisd.hawaii.gov/health/environmental/vector/index.html>

Additional Resources



Mahalo to Our Valued Contributors:

Big Island Resource Conservation & Development

101 Aupuni Street, #229A
Hilo, HI 96720
(808) 933-6996
www.bigislandrccd.org

City and County of Honolulu

Department of Environmental Services
1000 Uluohia Street, Suite 303
Kapolei, HI 96707
(808) 692-5159
www.cleanwaterhonolulu.com

Hawaii State Department of Land and Natural Resources

Division of Forestry and Wildlife
1151 Punchbowl St. Rm. 325
Honolulu, HI 96813
(808) 587-0166
www.dofaw.net

Hawaii State Department of Transportation

Aliiimoku Building, Room 506
869 Punchbowl Street
Honolulu, HI 96813
(808) 587-2160
www.hawaii.gov/dot/highways/index.htm

Honolulu Board of Water Supply

630 South Beretania Street
Honolulu, HI 96843
(808) 748-5936
www.boardofwatersupply.com

Natural Resources Conservation Service

99-193 Aiea Heights Drive, #109
Aiea, HI 96701
(808) 483-8600 ext. 3
www.hi.nrcs.usda.gov

Oahu Resource Conservation & Development

99-193 Aiea Heights Drive, #111
Aiea, HI 96701
(808) 483-8600 ext. 5
www.hi.nrcs.usda.gov/partnerships/oahurcd.html

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www.ctahr.hawaii.edu/nrem/