CHOOSING THE ROAD LESS TRAVELED

AN INTRODUCTION TO SUSTAINABLE FARMING IN HAWAI’I

November 2004
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Western Region Sustainable Agriculture Research and Education

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They are a scattering of verdant islands resting in the vast expanse of Pacific blue. These lands are the descendents of ancient and powerful volcanic forces, which have left a legacy of abundance. Awe inspiring mountain ridges and cliffs rise along their horizons, harvesting fresh water from the trade winds. Remote from all major land masses, they are home to hundreds of plant and animal species, many of them uniquely evolved and adapted to these isles.

These are the islands of Paradise: Hawai‘i.

The beauty and luxuriance of the Hawaiian islands have long stirred people’s hearts and enticed adventurers to stay and make their homes here. These lands excel in growing food and fiber — agriculture, in many forms, has been long practiced. From the original Hawaiians who grew kalo (taro), u‘ala (sweet potato) and ulu (breadfruit), through the industrial sugar plantation era, and up to today’s contemporary vision of diversified agriculture, we have learned much.

How do we cultivate the ‘aina (land), these magnificent island ecosystems, while maintaining their inherent natural wealth in perpetuity? What will agriculture look like in this century? How will the new farmers of Hawai‘i manage the natural resources with which they are entrusted?

THE PROMISE OF SUSTAINABLE AGRICULTURE

While no one will deny the remarkable increases in food production which we have enjoyed as the result of conventional farming, it has come at a price. The accelerated decline of family farming, environmental damage to air, soil, water, plant and animal resources, and lingering concerns about the health effects from chemical residues in the food supply were unintended consequences of conventional farming systems.

General consensus supports the opinion that the future of agriculture in the Pacific islands must be "sustainable." Sustainable farming systems are "capable of maintaining their productivity and usefulness to society indefinitely. Such systems... must be resource-conserving, socially supportive, commercially competitive, and environmentally sound."
The primary goals of sustainable agriculture include:

- Providing a more profitable farm income
- Promoting environmental stewardship, including: Protecting and improving soil quality; Reducing dependence on non-renewable resources, such as fuel and synthetic fertilizers and pesticides; and Minimizing adverse impacts on safety, wildlife, water quality and other environmental resources
- Promoting stable, thriving farm families and communities.\(^2\)

Management decisions for sustainable agriculture are not based on short term “bottom line” profits, but rather on long-term prosperity.

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A GOOD MATCH FOR PACIFIC ISLANDS

Sustainable agriculture makes sense for Pacific island ecosystems. Ecology-based farming which mimics nature provides long-term protection to our vulnerable land and water resources, to our endangered fauna and flora.

Sustainable agriculture is a good match for island ecosystems for a number of reasons.

- Human health is better protected. Sustainable methods emphasize using the least toxic chemicals available to produce food and fiber. Farmer, farm family, and farm workers' health are less at risk.

- The natural environment greatly benefits. Island water resources are less likely to be damaged by toxic agricultural chemicals. Conservation methods used on sustainable farms reduce soil erosion, protecting fishery resources by keeping reefs productive and sediment free. Diversified land uses on sustainable farms tend to improve wildlife habitat crucial to endangered plants and animals on Pacific islands.

- Sustainable agriculture stimulates the production and consumption of locally and regionally grown produce. Strong local food production helps to buffer our island food supplies from external forces. Our food security is enhanced. Our dependency on imported foods decreases.

- Healthy, tasty, fresh food can often command a price premium. Locally grown foods are fresher and, as a result, are often more tasty than imported foods. Fresh foods tend to have more vitamins and minerals.

- Sustainable agriculture focuses on getting more of the food dollar directly into the farmer's hands. As a result, sustainable agriculture tends to stimulate rural economies as well. Sustainable farms bring in more money, hire more people, and contribute to a more economically stable rural community.

- Often tourism plays an important role in Pacific island economies. There are opportunities for sustainable farms to expand into agritourism and to develop product lines to direct market to restaurants, hotels and resorts.

- With long distances and market forces dictating high fuel costs in the islands, sustainable agriculture with its emphasis on reducing fuel dependency is a logical choice.
A GOOD MATCH FOR NEW FARMERS

Many beginning farmers are finding that sustainable agriculture is very compatible with their resources and expectations.

- New farmers often may have limited fiscal resources. Sustainable agriculture tends to reduce reliance on purchased inputs by substituting them with greater management skills and more labor. For example, a beginning farmer may rely more on crop diversification, crop rotations, cover cropping and rotational grazing. However, the sustainable ag “equation” includes getting more cash directly into the farmer’s pocket.

- Initially new farmers usually produce such small volumes that their products must be direct marketed. Direct marketing techniques actively promoted by sustainable agriculture give new farmers excellent opportunities to hone their entrepreneurial and marketing skills. For example, at the local farmers’ market beginners can develop their niche markets, test new products, and get consumer feedback.

- A number of new farmers will make the choice of producing organic or sustainable products because of their personal philosophies of nutrition, health, animal rights, or economic equity. Sustainable and organic agriculture can give them an outlet and an income to follow through on their principles and convert their dreams into their quality of life.

AGRICULTURE: NOT FOR THE FAINT OF HEART

Contemporary farming is not an easy venture. The Northeast New Farmer Network report Listening to New Farmers identifies many of the factors required to be successful in farming today.

Farming production skills and knowledge: Successful farmers must possess knowledge, information and skills combined with practical expertise in a wide range of day-to-day physical tasks required to produce food or fiber products. Varying greatly with each farm enterprise, a farmer needs to know about planting and harvesting multiple crops, animal husbandry, controlling pests and diseases, managing soil and water resources, and operating, maintaining and repairing farm equipment and facilities. Many of these skills are acquired only through experience. Generally those from a farming background (raised on a farm, from a farm family) have already obtained a large part of this skill set. Those from a non-farm background can “catch up” through farm employment and apprenticeships.

In addition to the practical hands-on production skills described above, the successful farmer today must possess (or have access to) superb farm management skills. Farm business, financial and marketing abilities cannot be overemphasized to be successful in today’s agri-business climate.

Farm management expertise: This includes skills needed to manage finances, people, time, and community relations. Business
and marketing skills (budgeting, marketing, publicity, promotion, sales) are crucial. Planning ability for dealing with daily production tasks as well as long-range goals is required. Addressing legal issues and regulations for labor and land use are also included in this category.

**Resources:** Includes access to resources, particularly land (land ownership, land rental, special lease arrangements), water (for irrigation), capital, and markets (both market demand and actual outlets). Resources also include the accessibility to farming institutions and infrastructure such as consultants, input suppliers, repair and market facilities, credit institutions.

**Family and community support, farming networks:** Whatever a farmer’s background, family and spousal support is critical, as is a farmer-peer network for obtaining information and sharing resources, experience, and solving common problems. Social support encompasses overall community understanding and encouragement of farming, acceptability and tolerance of farming, and access to farming expertise, including farming mentors. Social recognition and respect affects resource access, including availability of expertise, land and credit. Lenders may not provide credit if they perceive farming to be an unacceptable investment.

**THE DOWN SIDE**

It would be naïve to consider a farming lifestyle without candidly examining some of the negative issues associated with agriculture.

- **Uncertainty of income:** It is frequently necessary to live on off-farm income and life’s savings in the early stages of a new farm business.

- **Risk of losing your entire investment:** Your farm could fail. Your new business is weather-dependent and subject to damage from insects, diseases, or thieves. Consider how likely this is to happen. Can you lower this risk?

- **Long hours and hard work:** Farming is not a 9 to 5 job. It requires high stamina and is physically demanding. The types of work and the demands on your time vary significantly and may be seasonal. During the start-up phase of your farm business you will have little time or energy for anything else.

- **Safety Issues:** Many farming activities are hazardous, working around mechanized equipment and using certain farm chemicals. Health coverage is expensive but necessary.

- **Lower initial income:** During the first few years of your new farm business you must be able to adjust to living with less money.

- **High levels of stress:** Starting and running a new farm business is highly stressful. You may be investing all of your assets into this business, planning to borrow large sums of money and perhaps giving up a steady job.

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**OBSTACLES FOR BEGINNING FARMERS**

- Low income – farming does not pay well.
- Finding land and facilities
- Financing land acquisition
- Lack of start up capital (often financed via off farm jobs)
- Lack of production expertise
- Lack of marketing and business planning skills

From Finding the Niche: Case Studies of Beginning Small-Scale Farmers,
Wisconsin Rural Development Center
DO YOU HAVE WHAT IT TAKES?

While we hope we haven’t overly frightened you, it’s very important to realize just how difficult farming really is. Once they are actively employed in agriculture, many beginning farmers commonly observe that they had no idea how little they knew about farming. Plan on investing ample time and energy to research and learn about your prospective new career.

Here’s some advice from successful farmers on where to get more information.

**Talk to successful farmers.** You should not expect free advice - pay for their time or offer some form of compensation (your labor, etc.). Schedule your request for times when the farmer is not as busy. Farmer mentorship programs which connect beginning farmers with experienced ones may be locally available in your area.

**Work on a farm.** There is no substitute for hands on training and experience in this career. Check into apprenticeship programs with successful farms which you think you’d like to own.

**Attend sustainable agriculture field days, workshops and conferences.** Focus on programs that feature farmer panels and farmers as presenters. While there, take advantage of your time by connecting with the speakers and other farmers attending. They can help encourage and support you.

**Join farming organizations.** There are farmer organizations for most agricultural commodities and for many niche products as well. Connect with them for sources of information and to attend annual conferences and workshops.

**Read sustainable agriculture farming newsletters and other publications.** Acres, USA, Stockman Grass Farmer and Small Farm Today are well respected sources of this type of information and many carry a large stock of books on related topics.

**Surf the internet.** Information on all aspects of sustainable and organic agriculture is abundant. Become proficient with computers and the internet – they’re an integral part of agribusiness today.
RESOURCES AND RECOMMENDED READING

COMPANION WEBSITE
Use this document in conjunction with the CTAHR website Links for New Farmers. Additional information and updates are posted there.
<www.ctahr.hawaii.edu/sustainag/newFarmer/links.asp>

SUSTAINABLE AGRICULTURE

ATTRA (Appropriate Technology Transfer for Rural Areas). The National Sustainable Agriculture Information Service is a very comprehensive source of information about all aspects of sustainable agriculture. Major topic areas include: what is sustainable agriculture, horticultural crops, field crops, soils and compost, pest management, organic farming, livestock, marketing and business, energy and agriculture, education, resources.
<attra.ncat.org/fundamental.html>

Sustainable Agriculture Research and Education (SARE). Website for USDA national sustainable agriculture program. <www.sare.org>

Exploring Sustainability in Agriculture (Sustainable Agriculture Research and Education, SARE). Available in both html and Adobe Acrobat versions, this is a great introduction to the concept of sustainable agriculture (what is sustainability, elements of sustainability) with ten excellent case studies (farmer profiles) to illustrate how these concepts can be applied.
<www.sare.org/publications/exploring.htm>

The New American Farmer (Sustainable Agriculture Research and Education, SARE). A collection of 50 in-depth interviews with farmers and ranchers which illustrate the great variety of production methods and the marketing creativity of sustainable farming operations thriving around the country. <www.sare.org/publications/naf.htm>

The New Farm: Farmer-to-Farmer Know How from The Rodale Institute. The Rodale Institute’s farming website features information, articles, products and services for “regenerative agriculture.” The Rodale Institute works worldwide to achieve a regenerative food system that renews the earth. Their activities include research, training, workshops, and information dissemination.
<www.newfarm.org/>

Hawaii’s Agricultural Gateway (Hawaii DOA) <www.hawaiiag.org>

MAGAZINES

Acres USA, A Voice for Eco-Agriculture. Describes itself as a national magazine devoted to sustainable agriculture. Their on-line catalogue features a wide array of publications relating to alternative agriculture. <www.acresusa.com/magazines/magazine.htm>

BOOKS

Exploring the Small Farm Dream: Is Starting an Agricultural Business Right for You? from the New England Small Farm Institute. This decision-making workbook uses a series of worksheets to guide you through the decision-making process to go into farming.
<www.smallfarm.org/>

Making Your Small Farm Profitable, by Ron Macher; published by Storey Books. <www.storey.com>

You Can Farm: The Entrepreneur’s Guide to Start and Succeed in a Farming Enterprise, by Joel Salatin; published by Chelsea Green Publishing.
CHAPTER 2

DIRECT MARKETING
DIRECT MARKETING

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Use this document in conjunction with the companion website:

Links for New Farmers
http://www.ctahr.hawaii.edu/sustainag/newFarmer/links.asp

hosted by the Sustainable Agriculture Program at the University of Hawaii College of Tropical Agriculture and Human Resources. Extensive additional information and updates are posted there.
DIRECT MARKETING

As a new farmer, you may be focusing on the physical parameters of your land, factors such as climate, soils, or pest pressures to determine what you will grow. While this is important, if you wish to have a business, before you plant or raise anything you need to determine what you can sell.

Faced with such high rates of farm bankruptcies, new farmers entering agriculture must be prepared to market their products. With direct marketing, the farmer makes sales directly to the consumer, generally getting higher prices and more income for their farm products. Both experienced and new farmers are integrating direct marketing into their farm enterprises as well as experimenting with new ways to generate farm income.

MARKET RESEARCH

It is beyond the scope of this manual to provide in depth information about how to conduct market research. However it is helpful to understand that market research is not difficult and can in large part be accomplished fairly easily by even the most novice farmer. It is, at its core, research and information gathering. It should be done before you decide what you want to produce.

Who will be your clients? Consider the demographics of the area where you are located to determine who your potential clients may be. Are your clients city dwellers who attend farmers’ markets? Will you sell to chefs at local high end restaurants? Do you hope to draw local residents to your farm to purchase locally grown produce or to enjoy a farm experience? Would you like to sell to a particular ethnic group? Are your clients health conscious individuals who demand high quality organic produce?

Learn everything you can about your potential clients. Find out their buying habits and their preferences. Observe them. Talk with them. Interview them. Survey them. Read about them. Try to determine if there is a need they have that you can fill. What products can you grow and produce that they would buy? How can you make your agricultural product uniquely different or superior to those of other farmers? Can you identify a lucrative niche?

Visit local stores. Take a trip to local supermarkets, ethnic shops, food clubs, health food stores and gourmet shops. Observe what is selling and what makes an agricultural product the most appealing. Talk to customers about what they want and about what they would like to purchase that isn’t currently available.

Why direct marketing?
To survive.
Marketing on the Edge

CERTIFIED ORGANIC

With consumers showing increasing concern about how their food is grown and avoiding pesticide residues, retail sales of organic products has grown steadily over the past ten years. New farmers wishing to capitalize on this movement may opt for getting organic certification.

National Organic Program
www.ams.usda.gov/nop/indexIE.htm

Hawaii Organic Farmers Association (HOFA)
www.hawaiiorganicfarmers.org
Research food trends. Visit high scale restaurants to get an early read on upcoming food fashions. Read food and food trade magazines. Women’s magazines can also be valuable resources. Keep a sharp eye out for articles in popular and health magazines about the nutritional and health benefits of specific foods.

Check out the competition. Examine what your future competitors are doing. Think about ways they could improve.

Decide what to grow. The answers to these questions will help direct your final decisions about the variety of agricultural products that you want to produce. Don’t compete with corporate farms ~ try to identify products that are not usually found in supermarkets or that don’t travel well. Look for varieties that are attractive, colorful, and diverse in size and texture.

Remember to emphasize diversity in your agricultural product line to spread your economic risks. For new products start small, with a limited field trial. Experiment with new varieties. Keep records to remember how well they grow. Then test your new products before you commit large amounts of your energy and resources to growing them.

Test your product: Get consumer feedback on your agricultural products by giving samples to your customers. For example, at the farmers’ market, craft shows or agricultural fairs, you can meet your customers face-to-face and get their reactions.

Direct Marketing Opportunities
The following pages will give you an overview of some of the most popular direct marketing techniques being employed by farmers. As you read, try to pick out the marketing venues which best match your current level of expertise and resources.

Farmers’ Markets
One of the best direct marketing venues for new farmers is the farmers’ market. At the farmers’ market, small scale producers can hone their business skills. This direct sales approach allows beginning farmers to establish their customer base, develop their marketing skills, test new products and get purchaser feedback at low cost. It requires little to get started (your best clean produce, a table, a vehicle, insurance) and incurs little debt.

To excel at farmers’ markets, you must enjoy people – and you’ll be answering a myriad of questions about things like nutrition, your favorite recipes, and farm philosophy among other food related topics. An eye for presentation is invaluable as well. Projecting an image of abundance with the creative use of color, signage, and multi-level product placement will draw customers to your stand. Use the farmers’ market to help you develop your niche products. Talk to your clients. Match what you grow the best with what your clients like to buy. Take time at the farmers’ market to network with other farmers as well. They’re often your best teachers.

HOT PRODUCTS at the Farmers’ Market
• Fresh products (tree or vine ripened, fresh from the farm)
• Specialty items not found in supermarkets (new, unusual, exotic)
• Heirloom varieties
• Salad mix
• Herbs
• Ethnic
• Organic items
• Fresh flowers
• Value-added products

From The New Farmers’ Market by Vance Corum, Marcie Rosenzweig and Eric Gibson.
Aside from the farmers’ market, you may discover opportunities to sell your products at agricultural fairs, craft shows, and trade events as well.

Some marketing prospects which may arise from your contacts at the Farmer’s Market include direct sales, subscription farming, and value-added sales.

**FARM STANDS**

If your farm is well located, along major roadways with lots of traffic, and close to an urban area or tourist attraction, you may want to try building a farm stand to market your produce. The marketing and display skills that you learned from farmers’ markets can be directly applied to your farm stand venture.

Road stands can give a farmer an excellent start-up marketing outlet. You can start small with a modest seasonal stall and, as opportunity and ambition permit, expand to a year round country attraction with an expansive product line. Here are some considerations you should take into account.

- **Location:** Consumer studies from the mainland indicate that most people will only drive ten to twenty-five miles to shop at a roadside stand. If your farm isn’t located within this distance, consider partnering other farmers with a better location.

- **Zoning restrictions:** Check to see if the zoning ordinances for your property allow farm stands.

- **Building permits:** Farm stands range in design from the most simple open framed stall to elaborate buildings with extensive amenities. Initially you may wish to keep your costs down and start small (but keep room for expansion should your farm business prove to be very successful). If you do erect a structure, check first to determine if you need local building permits. Be sure your roadside stand parking lot is convenient, level and safe. There may be regulations which apply to your farm stand signage as well.

- **Government and local regulations:** Be sure you research and understand the state and local laws which affect on-farm sales. You may be subject to business licensing regulations, health and sanitation codes, weight and measures specifications, employment regulations, and fire and police ordinances.

- **Insurance:** Once you allow the public access to your property, you expose yourself to a greater risk. Check with your insurance carrier to be sure you have adequate liability coverage.

- **Security:** Roadside stands are vulnerable to theft and vandalism.

Your farm stand may eventually evolve into a **roadside market** (or a **farm store**), a direct market outlet that operates year round and

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**Where Does Your Food Come From?**

**Buy Locally Grown.**

It’s thousands of miles fresher.

There Are Many Good Reasons To Buy Locally Grown Food

You’ll get exceptional taste and freshness. Local food is fresher and tastes better than food shipped long distances from other states or countries. Local farmers can offer produce varieties bred for taste and freshness rather than for shipping and long shelf life.

You’ll strengthen your local economy. Buying local food keeps your dollars circulating in your community. Getting to know the farmers who grow your food builds relationships based on understanding and trust, the foundation of strong communities.

You’ll support endangered family farms. There’s never been a more critical time to support your farming neighbors. With each local food purchase, you ensure that more of your money spent on food goes to the farmer.

You’ll safeguard your family’s health. Knowing where your food comes from and how it is grown or raised enables you to choose safe food from farmers who avoid or reduce their use of chemicals, pesticides, hormones, antibiotics, or genetically modified seed in their operations. Buy food from local farmers you trust.

You’ll protect the environment. Local food doesn’t have to travel far. This reduces carbon dioxide emissions and packing materials. Buying local food also helps to make farming more profitable and selling farmland for development less attractive.

When you buy local food, you vote with your food dollar. This ensures that family farms in your community will continue to thrive and that healthy, flavorful, plentiful food will be available for future generations.

Courtesy of Foodworks Network <www.foodroutes.org>
sells a wide variety of products. You would most likely be re-selling products from other farms in addition to your own agricultural products. Often these businesses use fresh produce as the major draw but diversify by adding food sales (such as a bakery or ice cream parlor, value-added products) or an entertainment component (animal petting zoos, mazes, hayrides, etc.). Read more about ag tourism further on.

U-PICK
Also known as “pick-your-own,” u-pick farming once seemed like a farmer’s dream come true — free labor. Customers would drive out to your farm, harvest and pack your produce, and then pay you for the experience! Actually U-pick does have a downside — your customers may damage your plants, accident liability insurance costs increase, and product prices tend to be low. However, it may still be a marketing option for some new farmers.

U-pick farming’s popularity appears to be tied to the economy and to the amount of time available to the cook of the household. Traditionally, u-pick flourishes when money is tight. Customers come to the farm to harvest lower priced foods which can be canned, frozen or preserved at home, helping keep the family food budget down. With more people working, time is now more at a premium and u-pick revenue has declined.

In today’s market, successful U-pick operations now generally include a component of ag tourism.

AG TOURISM
As urbanization increases and the hustle and bustle of city life ratchets up stress levels, many people are turning to nostalgic farm visits to spend their vacation dollars. Entrepreneurial farmers exploiting this trend can access recreational dollars in a number of creative ways. Some farmers are hosting events such as seasonal festivals (ex: Kona Coffee Festival) or agricultural fairs complete with cooking and crafting demos (The Ulupalakua Thing, Maui). Others may offer educational tours to appeal to local K-12 school students, showcasing processing demonstrations and providing displays and animal petting areas. Certain farms lend themselves to being marketed for weddings, corporate picnics and birthday parties. Farm families may open their homes to offer farm vacations or Bed and Breakfast stays. This marketing movement, known as entertainment farming or agri-tourism, is helping many farmers to stay in business.

Several Hawaii farmers have gotten a beginning in ag tourism via a Bed & Breakfast. If your county permits this form of business, if your farm or home has comfortable facilities to accommodate visitors, and if you and your family have the personality to interact cheerfully with the strangers who will be your guests, this may be a great option for your farm. Local farmers who are in the B&B business strongly recommend being affiliated with a Bed and Breakfast association, as it provides time-saving marketing services (via brochures and internet sales) which enhance the B&B sales. Expect to give a tour of your property and to have some products to sell to your guests.
In many cases ag tourism represents an evolutionary step for farmers who already have extensive experience with direct marketing via retail sales, value-adding, and food service. As described earlier, when you bring the public to your property you must address additional issues such as zoning restrictions, building and business permits, adequate parking, health code requirements, and increased liability risks.

In Hawaii and the Pacific, tourism has been a major sector of our local economy. Ag tourism can open a new niche market for our visitor industry. Contact the Hawaii State Department of Tourism (Product Enrichment Program) and the Department of Agriculture (Marketing Division) for assistance in setting up an agricultural-based tour product such as a farm festival or on-farm tour.

SUBSCRIPTION FARMING

In subscription farming, farmers contract with their customers to provide a range of goods for a defined time period (a “season” in temperate climates). Customers prepay, allowing the farmer to cover production costs in advance and guaranteeing a good price for the produce. In exchange, clients receive a box of fresh, high quality produce weekly, usually delivered to a central pick-up spot. They also have the satisfaction of knowing where their food comes from and that they’re supporting a local family farm. Another similar term is Community Supported Agriculture (CSA), where “shareholders” additionally commit time and energy on the farm to help with labor. People who relish the occasional experience of being on the farm and working the land may prefer to join a CSA.

Subscription farming enterprises thrive where small farms can provide a diverse array of consumer-ready products such as vegetables, fruits, herbs, meats, honey, milk products, and eggs to large urban populations located close to the farm. In Hawaii, apartment and condominium dwellers may prove to be a good market for this type of venture.

When you consider entering subscription farming, consider the following:

- **Production Diversity:** To keep subscribers happy, the farmer will need to produce a consistent supply and a wide range of fruits and vegetables. This requires a level of experience, growing and production skills which may take a couple of years for an entry-level farmer to learn. You may wish to partner with several other farmers to provide the variety needed to satisfy your customers.

- **Planting times and successive plantings:** The farmer needs excellent planning skills to ensure a constant supply of popular fruits and vegetables. If you’re just starting out in farming, start small and keep your initial crop list fairly simple and basic. With time and experience, you can add more variety to your produce boxes.

THE CULINARY CONNECTION

The Culinary Institute of the Pacific is a network of seven culinary education centers within the University of Hawaii system, located on the islands of O’ahu, Maui, Hawai’i, and Kaua’i. Kapi’olani Community College has premiered a culinary tour, “A Taste of Oahu – a Hands-On Culinary Experience” for the visitor industry which includes a visit to a local farm.

In her book *Selling Produce to Restaurants*, Diane Green of Greentree Naturals describes how serving her farmers’ market customers evolved into a small subscription farming program.

“Initially, we targeted our established farmers’ market customers who often showed up too late to get the items they wanted. A lot of people want to shop at the farmers’ market for farm fresh, certified organic produce, but don’t want to spend their first day of the weekend having to show up early to get the best choice. So, I suggested that they give me their weekly grocery list, and I would bag it up and save it for them to come to market later. From this beginning, we then researched the SSA model, and began a local subscription service.”
Deliveries: A common pick up point, easily accessible to your customers and preferably equipped with refrigeration can be hard to come by. It is best if you can find a group of subscribers who are located close together, such as in a common neighborhood or at a place of business. Try to discourage home deliveries – they are expensive and time consuming.

Shareholders: Word of mouth tends to be the best form of advertising for subscription farming. Often satisfied shareholders will recruit for you. Be sure you have a brochure that explains what subscription farming is all about and sets realistic expectations for your subscribers.

RESTAURANT SALES

The Hawaii Regional Cuisine movement has initiated some very beneficial relationships between talented local chefs and exceptional local farmers. While it may look easy to the outsider, in reality only farmers with a certain level of expertise are able to supply the consistently high quality produce demanded by restaurants and resort hotels. In addition, these chefs expect premium service as part of the product.

Before deciding to direct market your products to local restaurants, consider this:

- **Highest Quality Produce**: To command a price premium you must provide a product which is superlative – fresh, delicious and reliably delivered. You must be able to consistently provide your restaurant clients with excellent produce over the course of the year (despite weather or pest problems). Guarantee your products and replace them if needed.

- **Highest Quality Service**: Part of the product which you will provide includes reliable deliveries as determined by the chef’s schedule and terms. You must establish a good relationship with both the chef and the business manager to be successful. Keep up with gourmet food trends and meet periodically with the chef to discuss what to grow and how to specialize your produce for their restaurant.

VALUE ADDING WITH PROCESSING

Once you’ve gotten some experience, you might want to add some value-added products to your lineup of merchandise. Perhaps your less-than-perfect produce can be made into pickles, relish, salsa, chutney, jam or jelly? Value-adding means that the farmer processes their product in some way (by cleaning, cooling, cooking, drying, handcrafting, spinning, weaving, etc.) and then labels, packages and sells it through direct marking techniques. Value adding is a great way to diversify your product line and to cushion your income for times of crop losses or during off-seasons.

“Dean Okimoto, the owner-operator of Nalo Farms, has built a highly successful business by supplying excellent-quality salad greens and fresh herbs to many of Hawaii’s top restaurants. Dean started with one restaurant in the early nineties and has expanded to where his client list today includes most of Honolulu’s top restaurants and chefs, who in turn have won international recognition and numerous culinary awards for innovations such as Pacific Rim cuisine and Hawaii regional cuisine. Many establishments prominently feature Dean’s signature product Nalo Greens, a premier salad mix, on their menu.”

From Nalo Farms: Servicing High-End Restaurants
Expanding from fresh products into a processed food product line may appear deceptively simple. There are several steps, many of which are intertwined with complex government regulations.

- **Recipe development** – You may have a good recipe already for your fruits or vegetables. If you don’t, consider partnering with a local chef or with a culinary school or program to develop one. Your next step is to “commercialize” your recipe – to make necessary modifications so that it still tastes great in larger batches. Your recipe will be a proprietary secret.

- **Processing facility options** – To sell to the public you need to prepare your product in an approved food processing facility (or invest to build and maintain a commercial kitchen on your farm). There are specific federal, state and local laws and regulations regarding the processing of farm products, including livestock and poultry, and produce handling, cooking and packaging.

- **Ingredients and Packaging** – You’ll need to locate reasonably priced suppliers for the additional ingredients and packaging required for your product.

- **Labeling** – In addition to the marketing considerations you need to think of when designing your labels, food product labels have certain government required elements which must be met.

- **Product costs and product pricing** – To make a profit, you need to know your costs of production (both fixed and variable) and to determine your pricing strategy.

Value adding is an excellent way to grow and diversify your farm business. Successful agricultural entrepreneurs emphasize that you should start small and grow this aspect of your business slowly.

**INTERNET MARKETING**

Many farmers are finding that having a website greatly enhances their direct marketing strategies. Many farmers in Hawaii find them especially helpful for attracting out of state visitors to their ag tourism enterprise (such as a bed and breakfast). Another successful use for websites is for repeat sales from satisfied customers from the mainland and overseas.

Designing and supporting an eye-catching website that rises above the crowd requires an unusual combination of journalistic ability, graphic design talent, and computer savvy. It is very time consuming. If this sounds intimidating to you, your first step may be to sign on with a website such as Local Harvest (www.localharvest.org) or FoodRoutes.org which will give you a free listing. Link up with a Hawaii-based non-profit food organization that promotes sustainable agriculture (for a mainland example, visit Community Involved in Sustaining Agriculture, CISA, at www.buylocalfood.com). Some colleges and universities host similar...
farmer friendly websites (visit Kapiolani Community College’s http://farmfresh.hawaii.edu/).

Farmers can collaborate to design a group website relating to a common marketing theme with individual web pages featuring a unique story about each member farm. Alternately you may be able to access professional assistance by joining a marketing cooperative, several of which provide websites as part of their services.

**COOPERATIVE MARKETING**

An excellent way to combine talents and resources is for a group (hui, using a local term) of farmers to organize into a cooperative to carry out some of the marketing functions done by middlemen. A marketing cooperative is an organization owned and operated by a group of farmers who produce similar products. Marketing co-ops may perform certain functions such as grading, packing, storing, cooling, shipping, promoting and selling. They may be able to negotiate volume discounts for purchasing production supplies (seed, fertilizer, containers, etc.) for their members.

Coops give participating farmers the opportunities and benefits of pooling products by grade and size, presenting a uniform product, and accessing services and economies of scale not available to the individual producer.

There are many existing Hawaii marketing cooperatives. The USDA Rural Development/Rural Business-Cooperative Service provides technical assistance to producers who are interested in forming a cooperative.

A cooperative can be organized to take on other business functions. There is a new trend for farmers to organize both formal cooperatives and informal partnerships to share the cost and use of expensive equipment (such as poultry processing equipment and refrigerated “portable stores”) and for building commonly shared facilities (such as freezers and commercial kitchens). These new alliances are allowing farmers to be more competitive and to stay in business.

**MANY MARKETING OPTIONS**

While we’ve discussed direct marketing at great length, primarily because it will give you the lion’s share of the consumer’s food dollar, there are many other marketing venues which we have not covered. You have the option of selling your product directly to wholesalers, to retailers, and to food processors.

Wholesalers are traditionally the farmer’s link to the marketing chain. Generally wholesalers package and grade a wide variety of agricultural products, assemble them into economically sized lots, and transport them to a wide range of retailers. Wholesale prices are generally lower than retail or direct sales.

If you can provide a reliable supply of high quality product, graded and packaged, and deliver it directly to the retailer, direct retail sales might work for you. Investigate whether institutional buyers such as school systems, the prison system, hotel
chains, retail store chains, warehouse stores, cruise lines, and the military are a good outlet for your product. If you have a niche product, specialty stores may be a good option.

Refer to the publication *This Hawaii Product went to Market* for excellent introductory information about these and other marketing options.

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**This Hawaii Product Went To Market:** The Basics of Produce, Floral, Seafood, Livestock, and Processed Product Businesses in Hawaii

- This excellent local resource introduces basic business skills and then expands into marketing in great detail.
- Some of the topic areas include:
  - marketing strategy
  - production and market statistics
  - Hawaii’s livestock products and markets
  - government assistance in marketing
  - grower or trade associations
  - marketing cooperatives
  - trade show basics
  - elements of package design
  - transporting your product
  - quarantine regulations
  - going commercial with a kitchen recipe
  - adding value
  - marketing to local retail florists, chefs, the military, institutional buyers, airport shops, and specialty stores
  - exporting to a foreign market.
COMPANION WEBSITE
Use this document in conjunction with the CTAHR website Links for New Farmers. Additional information and updates are posted there.
<www.ctahr.hawaii.edu/sustainag/newFarmer/links.asp>


North American Farmers Direct Marketing Association is an organization exclusively dedicated to promoting farm direct marketing. They offer publications, conferences, trade shows, newsletters, and a special website (The Back Forty) for members only. <www.nafdma.com/>

LOCALLY GROWN
FoodRoutes.org is a website devoted to assisting people to purchase locally grown produce. Their website offers a toolkit for food and farming advocacy work and several excellent downloadable promotional sheets such as Buy Locally Grown, It’s Thousands of Miles Fresher. <www.foodroutes.org/localfood/>

Local Harvest supports sustainable and organic farmers by providing a website with a clickable map for consumers to link up with local food producers. <www.localharvest.org/>

FARMERS’ MARKETS

Growing for Market Magazine, is a national monthly newsletter for direct market farmers. It is a source of information about growing and marketing produce, herbs and cut flowers. <www.growingformarket.com/>

Hawaii’s Agricultural Gateway (Hawaii DOA) - List of Hawaii Farmers’ Markets <www.hawaiiag.org/Markets/WelcometoMarkets.html>

ROADSIDE STANDS
How to Establish and Operate a Roadside Stand – UC Davis Small Farm Center <www.sfc.ucdavis.edu/Pubs/Family_Farm_Series/Marketing/roadside.html>

U-PICK
Should I grow fruits and vegetables? Pick Your Own Markets <ag.arizona.edu/arec/pubs/dmkt/Upick-ShouldIgrow.pdf>

AGTOURISM
Direct Farm Marketing and Tourism Handbook <ag.arizona.edu/arec/pubs/dmkt/dmkt.html>

Ag Tourism in Hawaii: From Farmer to Visitor, CTAHR Website <www2.ctahr.hawaii.edu/agtourism/>

ATTRA Entertainment Farming and Agri-Tourism: On-line article about agri-entertainment. Includes tips and ideas from successful entertainment farming enterprises and techniques (farm recreation and hospitality businesses). Also available as downloadable Adobe PDF file. <attra.ncat.org/attra-pub/entertainment.html>
Agricultural Tourism Fact Sheets from UC Davis
<www.sfc.ucdavis.edu/agritourism/factsheets.html>

SUBSCRIPTION AGRICULTURE AND COMMUNITY SUPPORTED AGRICULTURE
Community Supported Agriculture: Making the Connection. University of California Cooperative Extension. 1995

Sharing the Harvest, by Elizabeth Henderson with Robyn Van En. (Publisher: Chelsea Green. 1999). This manual provides an overview and step-by-step description of Community Supported Agriculture, including how to start and operate a CSA, management and production issues, sample documents from working CSA farms, pitfalls, and extensive resource and materials list.

RESTAURANT SALES
Selling Produce to Restaurants, by Diane Green, Greentree Naturals
<www.greentreenaturals.com>

Chefs Collaborative <www.chefscollaborative.org/>, a national network of more than 1,000 members of the food community who promote sustainable cuisine by celebrating the joys of local, seasonal, and artisanal cooking. It hosts the Farmer-Chef Connection website <www.farmerchefconnection.org>.

VALUE ADDING

CHAPTER 3

SUSTAINABLE AND ORGANIC PRODUCTION METHODS
SUSTAINABLE AND ORGANIC PRODUCTION METHODS

THE PHYSICAL ENVIRONMENT
Water
Climate
Soil
Soil Fertility
Organic Matter and the Soil Food Web
Soil Testing

KNOW YOUR PLANTS AND ANIMALS

PEST MANAGEMENT
Integrated Pest Management
Preventing Pest Outbreaks
Least Toxic Pesticides
Insect Management
Weed Management
Plant Disease Management

RESOURCES AND RECOMMENDED READING

Use this document in conjunction with the companion website:

Links for New Farmers
http://www.ctahr.hawaii.edu/sustainag/newFarmer/links.asp

hosted by the Sustainable Agriculture Program at the University of Hawaii College of Tropical Agriculture and Human Resources. Extensive additional information and updates are posted there.
Agriculture defies simple description and encompasses an extensive range of subjects and methods. By now you must realize that it is impossible to pick up a single book to learn how to produce high quality crops and animals. This section will direct the new farmer to information sources to learn about the biological, chemical and decision-making principles which guide their use of sustainable and organic practices on the farm.

**THE PHYSICAL ENVIRONMENT**
Beginning farmers must recognize that they work within the limits of an ecosystem. They optimize the fit between the animals and crops that they grow with the limiting features of the physical environment. They will select plants and livestock that are adapted to and will thrive in the localized micro-climate and weather region of Hawaii where they farm.

**WATER**
Farms require an abundant water supply for growing both plants and animals. Your water supply may largely determine what you can grow. Understand what the water sources are for your farm, where they come from. The most common water sources on Hawaii farms are county water or catchment tanks for rainwater collection. Become familiar with the water rights for the property and the water rates, if applicable. Get the water tested to determine if there is any contamination. Find out how much rainfall the farm receives and the annual precipitation rates. If you will need supplemental water, learn all you can about irrigation systems. Surface, sprinkler, drip or trickle irrigation systems offer lots of different possibilities depending on your crop and climate needs. Investigate how you can conserve water on-site by using methods such as cover cropping, mulching, terracing, and growing drought tolerant varieties.

Water management is a critical factor in maintaining optimum plant health. Learn to recognize the signals of water stress for your crops. Too much water can promote certain diseases such as Phytophthora root rot. Too little water can stress plants making them less resistant to attack from insects and plant pathogens.

**CLIMATE**
The amount of light (day length), heat, and the weather patterns (wind, rain, temperature, and humidity) will strongly influence what you can successfully grow on the farm.

**ORGANIC PRODUCTION HIGHLIGHT**
“Organic farming is a production system that avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock feed additives. To the maximum extent feasible, organic farming systems rely on crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, and aspects of biological pest control to maintain soil productivity and tilth, to support plant nutrients and to control insects, weeds and other pests.”
---US Department of Agriculture

**NOTE:** The use of genetically modified organisms (GMOs), human manures and sewage sludges, and food irradiation are not allowed in organic farming.

Where to Find CLIMATIC DATA

**Hawaii Climate Summaries**

**Hawaii Crop Weather Reports**
SOIL

The soil resource on the farm is another major physical feature which will help determine what you can produce. The USDA Natural Resources Conservation Service (NRCS) soil maps help you learn about important soil characteristics and limitations such as drainage, depth to bedrock, and texture. Check this on-line resource for maps for all of the Hawaiian islands to determine the capability grouping for the soils on your farm (<www.ctahr.hawaii.edu/soilsurvey/soils.htm>).

The beginning farmer needs to have a clear understanding of soil properties and processes. An excellent introductory publication, Building Soils for Better Crops, covers soil science fundamentals such as soil organic matter, the soil food web, nutrient cycles, tilth and aeration. Management methods, such as the use of cover crops, crop rotations, compost, animal manures, low and no-till methods to improve soil health are explained as well.

SOIL FERTILITY

In the past, conventional agriculture systems have emphasized meeting the nutritional requirements of plants primarily by applying easily soluble chemical fertilizers to the soil that were immediately available to the plants for nutrient uptake. Initially, yields were astounding. However, over time these farms came to experience serious declines in yield attributed to loss of organic matter, degradation of soil structure, and a depletion of micronutrients.

Today, as the soil biological sciences catch up with soil chemistry, we are gaining a more comprehensive understanding of the relationships between soil particles, microbes, insects and plants. As we learn, more “conventional” farmers are embracing the same production principles used in organic and sustainable production systems.

Sustainable and organic systems meet nutritional needs to a great extent by managing soil biology, chemistry, and structure to optimize soil fertility and nutrient cycling. These farmers focus on providing nutritional balance, which will include micronutrients. They farm with the goal of improving the soil habitat to allow beneficial soil microorganisms to flourish. This results in healthy plants which are better able to withstand pest and disease pressures. In addition, by using these methods, many farmers are reporting improved marketability and longer shelf life for their plant products.

To meet their nutrient needs, organic farmers generally rely on animal or plant products and by-products (fish emulsion, blood meal, feather meal, bone meal, alfalfa meal, soybean meal), rock minerals (high-calcium aglime, dolomitic limestone, various rock phosphates, gypsum, sulfate of potash-magnesia, mined potassium sulfate), and rock powders (glaconite/greensand, glacial gravel dust, lava sand, Azomite®, granite meal).

ORGANIC PRODUCTION HIGHLIGHT

What can I use?

Certified organic producers have certain restrictions on what can be used as a fertilizer, soil amendment or pesticide. The Organic Materials Review Institute (OMRI) provides a list of products and materials allowed and prohibited for use in organic agriculture.

www.omri.org
ORGANIC MATTER AND THE SOIL FOOD WEB

Much of the farmer’s efforts to improve and maintain soil health revolve around increasing and managing soil organic matter levels. Organic matter is important for keeping soil structure loose, to allow for good root penetration and water percolation. It can supply important plant nutrients such as nitrogen, phosphorous and sulfur. Adding organic matter can help reduce excessive soil compaction. In times of drought, organic matter will hold water for a longer period, reducing stress on the crop. Additions of organic matter often stimulate populations of beneficial soil microbes responsible for nutrient cycling. Some of these soil organisms prey on and reduce populations of damaging nematodes or plant disease organisms. Organic matter improves the ability of soils to retain nutrients.

The most common way to increase organic matter and nutrient cycling in soils is through applying green manures, animal manures, and composting.

Green manures (often nitrogen-fixing legumes) are crops grown primarily for the purpose of being plowed down back into soil to improve soil fertility and structure and are used extensively in organic production. Because they remove a field from production while growing, in the past they have not been popular with local conventional farmers. However green manures are rapidly gaining wide-spread acceptance in Hawaii for breaking disease cycles.

A related practice, cover cropping, can have the same beneficial effects as green manuring. Managing Cover Crops Profitably, a book available from SARE (Sustainable Agriculture Research and Education), gives the new farmer a comprehensive introduction to green manures and cover crops. The University of Hawaii has a tropical cover crop and green manure database with information about plants suitable for local island agriculture (<www.ctahr.hawaii.edu/sustainag/Database.asp>).

Livestock manures and manure composts are also traditional sources of organic matter and soil fertility. Unfortunately in present-day agriculture, crop and livestock production are frequently segregated, making it difficult to source and costly to haul to the farm fields. Gradually this trend is reversing as it becomes more common for livestock and crop farmers to form partnerships for manure recycling.

Because of the risk of certain bacteria and viruses that can be spread through raw manure, it is good to exercise a bit of caution. Refer to the side bar to familiarize yourself with the USDA regulations regarding the use of manures on organic farms.

Compost is also a great source for building organic matter. It not only builds organic matter, but also balances pH levels in soil, helps with moisture retention, and breaks up clay soils. It is considered a slow releasing fertilizer with significant amounts of nitrogen, potassium, phosphorus. It is full of micronutrients and large popu-
lations of beneficial microbes. Presently, finding a steady source of finished compost in this state is fairly difficult so many farmers make it themselves. Refer to the side bar for guidelines from the USDA on making composting. Contact your cooperative extension agent to find out about upcoming compost workshops in your area. Also check with local recycling programs such as Recycle Hawaii on the Big Island and Opala on O‘ahu.

For additional information about animal manures and composting, refer to Chapter 5, Animal Production.

SOIL TESTING

Farmers using sustainable and organic production methods often use soil and plant tissue test results to help them determine what they need to grow crops. The farmer will apply organic or chemical fertilizers based on the uptake rates for their crop. Since nutrient and mineral requirements vary from crop to crop, the farmer must become familiar with each plant’s nutrient requirements and match them to their soil conditions. Consult your local extension office to obtain information about nutrient and mineral requirements for the crops you wish to grow. Again, a clear understanding of nutrient cycles, especially for nitrogen and phosphorus, is vital for successful sustainable and organic production.

With our state’s current emphasis on diversified agriculture and market expansion, there are many information gaps on the nutrient needs of the new varieties and exotic tropical crops being grown. You may need to do some small test plots and experiment with fertility rates at your own farm. With experience you will come to recognize optimal plant health by observing plant color, stem structure, and overall plant vigor.

The University of Hawaii Agricultural Diagnostic Service Center (ADSC) lab conducts standard chemical analyses of soils, plant tissue, water and nutrient solutions (as well as plant disease, feed and forage, and insect identification analyses). Fertilizer recommendations from ADSC are calibrated to the soils of Hawaii. Micronutrients are generally measured through plant tissue analyses. Organic farmers will need to adjust standard ADSC recommendations since they will not be appropriate for organic fertilizer application rates. Consult with your extension service professionals for assistance in understanding test results and recommendations.

Several mainland laboratories now offer soil testing services for biological parameters, which is still a relatively new field within the soil sciences. There are also “alternative” soil testing labs which base their recommendations on a different soil fertility system (known as the Albrecht system, cation nutrient balancing, the CEC or base saturation approach). Be sure to ask if the recommendations from these mainland labs are calibrated and accurate for Hawaii soil conditions.
KNOW YOUR PLANTS AND ANIMALS

We are assuming that you have read the section on direct marketing and are now very “akamai” (Hawaiian for smart, clever, expert) about selecting the diverse range of crops and animals that you plan to grow (based, of course, on what you can sell). If you don’t have access to property, now would be the time to research the optimal environment to grow your agricultural products. If, however, you already have land, you should match your choice of crops and livestock to your physical environment.

When considering what to grow, learn everything you can about the biology of the species. Nothing can take the place of the farmer’s thorough knowledge of the life cycle, nutritional needs, water requirements and pest problems of their crop. You’ll need to know the lowest and highest temperatures that can be tolerated, how many days to harvest, the pH, moisture and fertility requirements. There are volumes of information available from the Cooperative Extension Service, the educational outreach agency of the land grant University of Hawaii. Look to other major universities located in similar climatic areas, such as the Universities of Florida and California, for additional sources of information. Seed companies also usually provide cultural information about their products.

To match plants and animals to your local environment, look into the origin of the species, where it grows naturally, and how it performs commercially. Compare this with the crops and animals already being raised in your area. Ask older farmers what they used to grow and what they are growing now. Make sure you can source healthy, locally adapted stock.

Crops that are in excellent health and well adapted to the local environment are more able to withstand insect damage and disease. You decrease your risks of pest damage by selecting the right plants and animals for your property. (With more experience, you may try to push the limits of your ecosystem to get a price premium for a product that is more difficult to grow in Hawaii.)

PEST MANAGEMENT

Farmers around the world invest considerable time and energy to protect their crops from disease and pests. In the recent past, pest control was considered to be synonymous with pesticide use. Over time, the folly of relying too much on pesticides became apparent. Pest species began to develop resistance to the pesticides. Pest resurgence (a rebound of the pest species, often to higher levels than before) occurred because natural enemies which had once held pest populations in check had been killed. Secondary pest outbreaks began to become a problem. Pollinator species such as honey bees, leaf-cutting bees, alkali bees and bumblebees were damaged, with resulting crop declines. Pesticide residues began to be observed in air, soil, water, as well as in the food supply and accumulated in the human body.

ORGANIC CERTIFICATION

If you have not used prohibited products on your farm for three years, you may be eligible for organic certification. To claim to be “organic” (with annual gross sales over $5,000), your farm will need to be inspected and certified by an accredited agency. Be prepared to provide detailed information to document your growing practices (pest, disease, and fertilization strategies, land use history, and a detailed map). Your farm will be physically inspected and a report prepared. After receiving final approval you may label your products “certified organic.”

Stinkbug, a common pest of Hawaii crops
A new approach to pest control was developed and is widely used today, embraced by both conventional and organic farming communities, and replacing the chemical “silver bullet” approach. **Integrated pest management** (IPM) emphasizes monitoring and identifying pests and natural enemies, preventing pest outbreaks, and using the least toxic materials available to manage pest species.

**INTEGRATED PEST MANAGEMENT**

According to the US Environmental Protection Agency (USEPA), IPM is a series of pest management evaluations, decisions and controls. In practicing IPM, growers who are aware of the potential for pest infestation follow a four-tiered approach. The four steps include:

1. **Prevention**: As a first line of pest control, IPM programs work to manage the crop to prevent pests from becoming a threat. In an agricultural crop, this may mean using cultural methods, such as rotating between different crops, selecting pest-resistant varieties, and planting pest-free rootstock. These control methods can be very effective and cost-efficient and present little to no risk to people or the environment.

2. **Monitor and Identify Pests**: Not all insects, weeds, and other living organisms require control. Many organisms are innocuous, and some are even beneficial. IPM programs work to monitor for pests and identify them accurately, so that appropriate control decisions can be made in conjunction with action thresholds. This monitoring and identification removes the possibility that pesticides will be used when they are not really needed or that the wrong kind of pesticide will be used.

3. **Set Action Thresholds**: Before taking any pest control action, IPM first sets an action threshold, a point at which pest populations or environmental conditions indicate that pest control action must be taken. Sighting a single pest does not always mean control is needed. The level at which pests will become an economic threat is critical to guide future pest control decisions.

4. **Control**: Once monitoring, identification, and action thresholds indicate that pest control is required, and preventive methods are no longer effective or available, IPM programs then evaluate the proper control method both for effectiveness and risk. Effective, less risky pest controls are chosen first, including highly targeted chemicals, such as pheromones to disrupt pest mating, or mechanical control such as trapping and weeding, or physical barriers such as sticky tapes. If further monitoring, identifications and action thresholds indicate that less risky controls are not working, then additional pest control methods would be employed, such as targeted spraying of pesticides. Broadcast spraying of non-specific pesticides is a last resort.
PREVENTING PEST OUTBREAKS

The strategies used by successful farmers for pest control are sequential - they first use preventive measures to keep pest populations low.

- **Site Selection**: Select a site that is pest free, and chose plant species and varieties particularly well suited to the site. Assess adjacent areas for pest problems as well.

- **Resistant cultivars**: Plant pest resistant cultivars and varieties. Plant breeders and genetic engineers are producing a new array of plants with resistances to insects, plant pathogens and nematodes.

- **Sanitation**: Use good sanitation to prevent infecting your crops and livestock. Use disease-free seed and vegetative pieces (tubers, rootstock, etc.) for initial planting. Clean equipment that is transferred between sites to prevent spreading pathogens, weeds, and nematodes. Be sure your irrigation water is clean. Remove unharvested crops which might provide shelter and food sources to unwanted pests.

- **Habitat**: Modify the habitat to make it unfavorable for pest species. Areas adjacent to your crops may provide food, shelter, and alternate hosts that allow pest species to survive. Plants that can harbor pests should be replaced with plants that shelter beneficial organisms.

- **Cover crops**: Cover crops can suppress weeds and provide food and shelter to beneficial insects, mites and spiders.

- **Crop rotations**: Alternate the sequence of crops grown in a field to prevent populations of soil-borne plant pathogens and nematodes to build up.

- **Planting and harvesting dates**: In certain cases, the planting and harvesting dates for the crop can be adjusted to favor crop growth and avoid seasons with large pest outbreaks.

- **Proper irrigation and water management**: Pest outbreaks can be triggered by improper water management practices. For example, certain root and crown diseases can be aggravated by excess water. Certain weeds favor areas with poor drainage.

- **Soil drainage**: Prepare the land properly. When tilling and cultivating the soil, be sure to use methods which reduce soil compaction and provide good drainage.

- **Fertilizer and soil amendments**: Over fertilization (especially with nitrogen) may attract or enhance development of pest species.

**INCREASING BIODIVERSITY**

“Ideally, agricultural landscapes will look like patchwork quilts: dissimilar types of crops growing at various stages and under diverse management practices. Within this confusing patchwork, pests will encounter a broader range of stresses and will have trouble locating their hosts in both space and time. Their resistance to control measures also will be hampered. As plant diversity intensifies above ground, diversity builds in the soil. Through a system of checks and balances, a medley of soil organisms helps maintain low populations of many pests. Good soil tilth and generous quantities of organic matter also can stimulate this very useful diversity in pest-fighting soil organisms.” -

*‘Naturalize’ Your Farming System: A Whole-Farm Approach to Managing Pests*
Since pests are controlled most effectively when their populations are low, experienced farmers act before pest problems reach devastating levels. This is accomplished by setting an “action threshold” - a pest population level where some form of control must be taken to avoid economic or aesthetic damage to the crop.

If there is a pest outbreak after using preventive measures and the action threshold is passed, the farmer will move to the next strategy, using effective low risk controls to reduce pest populations. For example, mating disruptors, sticky traps, and physical barriers are examples of non-toxic methods to reduce insect pests.

If pest populations continue to escalate and cause unacceptable levels of damage, pesticides are generally used. Most pesticides are chemicals which are intended to damage or kill pest species. Unfortunately, these same chemicals can poison or injure humans as well. Farmers, farm workers, and farm families can be exposed to these products by mouth, by inhalation, and through the skin or eyes. Effects can be acute (with symptoms appearing within 24 hours) or delayed. They may be the result of a single exposure to a chemical, to repeated exposure, or from exposure to a combination of chemicals. Some illnesses which may be traced to pesticide exposure include tumors, cancers, chromosome damage, birth defects, miscarriage, infertility and sterility, and systemic disorders of the blood, brain and nervous systems, skin, lung and respiratory systems, and liver and kidneys.

Federal and state laws strictly regulate the use of pesticides. General use pesticides are available to anyone and are considered to be safe if used according to label directions. Restricted use pesticides are more hazardous to human health or the environment and are not available for public use. Farmers or ranchers wishing to use restricted-use pesticides on crops on their property must pass a certification exam administered by the Hawaii Department of Agriculture. The exam tests your ability to interpret pesticide labels and to apply label information to pest management problems. You are expected to understand proper handling, calibration, storage, and disposal techniques; first aid and emergency response; and the fate of pesticides in the environment. The University of Hawaii Cooperative Extension Service offers training materials and classes to prepare for the certification exam. Additional information is available at the Pesticide Extension website: <http://pesticides.hawaii.edu/>.

There are several criteria for pesticide selection such as toxicity (especially to humans), selectivity (range of organisms it will impact), persistence (length of time it takes to degrade), and mode of action (method chemical uses to kill target organism).

Organic farmers will select the least toxic pesticide permitted under the National Organic Program’s National List of Allowed and Prohibited Substances. Currently, there are a variety of organic approved pesticides for sale on the market. Most of them are vinegar, clove oil or lemon based products.
Hawaii’s year-round subtropical climate provides excellent growing conditions for many insect species. Lacking a winter season with temperature extremes and a fallow period, pest populations can rapidly build to damaging levels. The war on insect species is continuous and farmers must be constantly observing their fields and keeping records of what they find. In addition, new pests are constantly arriving on our shores.

Insect identification is complicated because many insects undergo major changes between their immature and adult stages. Farmers need to learn what insect pests and their natural enemies look like throughout their life cycles. Knowledge of their habitat requirements, their mode of dispersal and movement, and the type of damage they do is helpful. There are many resources available to learn some basic entomology.

Plan weekly inspections in the field with a hand lens and a photographic identification key. In the beginning, you may need to hire a trained pest control advisor or scout to help with insect ID.

**CULTURAL CONTROLS**
- **site selection** – choose sites and adjacent areas free from insect pests
- **use resistant or tolerant cultivars**
- **habitat manipulation** – destroy sections that harbor pests, enhance areas that provide food and shelter for beneficial insects (field borders, insectaries)
- **cover crops** – select plants to provide habitat for beneficials
- **trap crops** – use to lure pests away from cash crop
- **crop rotation** – alternate pest-susceptible crops with pest-resistant crops to avoid build up of pest populations
- **adjust planting and harvesting dates** – avoid seasons with peak pest outbreaks
- **proper irrigation/ water management** – especially avoid water stress
- **fertilizer management** – avoid excessive nitrogen fertilization
- **fallow period** – to reduce insect pest populations in soil (cutworms, root maggots)

**MECHANICAL CONTROLS**
- **soil tillage** – expose insects to birds and predators
- **birds** – chicken, ducks, geese
- **vacuums**
- **barriers** – floating row covers, plastic tunnels, sticky barriers, reflective mulches
- **traps**

**BIOLOGICAL CONTROLS**
- **conservation and enhancement of natural enemies** – predatory arthropods, parasitic insects, nematodes, pathogens, vertebrates (birds/bats/fish)
- **augmentation** – natural enemies augmented and released

**CHEMICAL CONTROLS**
- **less toxic insecticides** – mating disruptors
- **conventional insecticides**
- **organic insecticides**
WEED MANAGEMENT

CULTURAL CONTROLS
• site selection – choose sites and adjacent areas free from weed pests
• sanitation – clean machinery, clean irrigation water, weed free compost and manure
• transplants – use to outcompete weeds
• increase crop density – “close-plant” crop to outcompete weeds
• smother and cover crops – suppress weeds between rows
• mulches – old hay, straw, wood chips to suppress weeds between rows
• living mulch – cereal, clover or vetch crops grown between rows and killed before crop planting to avoid excessive competition with cash crop
• proper irrigation/water management – buried drip tape to minimize water available to weeds
• reduce weed seed bank – no weed allowed to go to seed; off-season weed control

MECHANICAL CONTROLS
• soil tillage – shallow cultivation
• mowing – before weeds set seed, at low soil moisture
• flaming
• stale seedbed – pre-germinate weeds then destroy by cultivation, herbicide or flamer
• solarization – plastic mulch over tilled, moist soil to allow solar energy to kill weed seeds

BIOLOGICAL CONTROLS
• insects
• pathogens
• vertebrates – fish, birds (Chinese weeder geese), cattle, sheep

CHEMICAL CONTROL
• conventional herbicides
• organic herbicides – acetic acid, citric acid, sodium nitrate, corn gluten

WEED MANAGEMENT

Weeds are the great competitors of the plant world. They possess features such as abundant seed production, rapid population establishment, seed dormancy, long-term survival of buried seed, adaptations for seed dispersal and vegetative reproduction, and the ability to invade sites disturbed by people. These properties make them formidable opponents in the battle for survival in your field. Weed control can be one of your biggest expenses.

There are many varied and creative strategies for weed control being currently used -- new types of farm machinery, rotational grazing with weed-eating animals, weed-suppressive cover crops, and modified flame throwers. All successful weed control strategies include preventing weed introduction and reseeding.

INVASIVE WEED?
Before you introducing a new plant to Hawaii, thoughtfully consider the weed description above. Does your new crop have any of these aggressive features? Could this plant some day make it onto Hawaii’s invasive species list? Could your green manure or cover crop jump the fence lines and naturalize in adjacent fields and forests?

Hawaii’s native forests have been badly damaged by invasive plant species, most of which were introduced by earlier generations of farmers, ranchers, horticulturists, and foresters.

Learn more about invasive plants and noxious weed in Chapter 4, The Farm as Habitat: Environmental Topics.

Pest Advisories

Check the Hawaii Dept. of Agriculture website for the latest pest advisories for our state. <www.hawaiianag.org/hdoa/pi_pa.htm>
PLANT DISEASE MANAGEMENT

Plant pathogens are microorganisms (fungi, bacteria, viruses, viroids, and phytoplasmas). They constantly mutate, resulting in new threats to your crop. Although Hawaii is remote and naturally relatively pathogen free, the local, regional and global movement of seed, plant materials and farming equipment makes new introduced pathogens a constant problem for our agriculture and environment.

Pathogen identification requires specialized knowledge and equipment - you may need assistance from a professional to accurately diagnose them. The Agricultural Diagnostic Service Center (ADSC) has on-staff plant pathologists to help you determine what is causing the problem.

When it comes down to disease, it’s all about prevention. The best practices minimize conditions that harbor disease. By incorporating good sanitation practices, appropriate watering techniques, good plant spacing, and being aware of new plant materials and farming equipment making its way on to your farm you can minimize the threats.

As researchers and farmers come to better understand microbiology, promising new methods to control plant disease using biological agents (such as disease-suppressive composts and compost teas) appear to be on the horizon.

PLANT DISEASE MANAGEMENT

fungi, bacteria, viruses, nematodes

CULTURAL CONTROLS
• site selection – choose sites and adjacent areas free from plant pathogens and pathogen vectors
• resistant cultivars – many new transgenic cultivars being developed
• sanitation – exclude pathogens with excellent sanitation practices at all points in production (in greenhouse, on equipment, in field).
• habitat manipulation – use green manures and composts to enhance beneficial organisms in soil food web and promote disease-suppressive soils
• cover crops – select non-host cover crops
• crop rotation – alternate non-host crops in rotation to avoid build up of pathogen populations; plant disease-suppressive crops (broccoli, mustards, sudangrass)
• adjust planting and harvesting dates – avoid seasons favorable to pathogen outbreaks
• proper irrigation/water management – overwatering favors most soilborne pathogenic fungi; overhead sprinkler irrigation favors foliar diseases (survival, dispersal, and disease development); drip irrigation or subsurface irrigation may be preferable
• soil drainage – poor soil and bed preparation can favor damping-off (fungi)
• fertilizer management – excessive nitrogen fertilization can promote pathogen susceptibility, raised pH levels can reduce symptom expression for club-root disease of crucifers
• fallow period – to reduce pathogen populations by keeping field host-free
• vector control – weed and insect hosts of viral and bacterial pathogens

MECHANICAL CONTROLS
• soil tillage – deep plow infected plant residues
• solarization – plastic mulch over tilled, moist soil to allow solar energy to kill weed seeds

BIOLOGICAL CONTROLS
• myco-pesticides
• disease-suppressive composts and compost teas

CHEMICAL CONTROL
• conventional pesticides
• organic pesticides – copper, sulfur, or bicarbonate based fungicides, oils, plant extracts, compost teas
RESOURCES AND RECOMMENDED READING

COMPANION WEBSITE
Use this document in conjunction with the CTAHR website Links for New Farmers. Additional information and updates are posted there.

<www.ctahr.hawaii.edu/sustainag/newFarmer/links.asp>

CLIMATE
Hawaii Climate Summaries (WRCC, NOAA) <www.wrcc.dri.edu/summary/climsmhi.html>
Hawaii and Pacific Island Local Climate Summaries (WRCC, NOAA) <www.wrcc.dri.edu/summary/lcdpi.html>
Hawaii Crop Weather Reports (HASS) <www.nass.usda.gov/hi/speccrop/weather.htm>

SOILS INFORMATION

GENERAL
USDA NRCS Hawaii Soil Survey: The “Hawaii Soils” site features on-line maps and descriptions of the soils found in the Hawaiian Islands. <www.ctahr.hawaii.edu/soilsurvey/soils.htm>


NRCS Soil Quality Institute Soil Biology Primer is an introduction to the living component of soil and how it contributes to agricultural productivity, and air and water quality. The Primer includes units describing the soil food web and its relationship to soil health, and units about bacteria, fungi, protozoa, nematodes, arthropods, and earthworms. <soils.usda.gov/sqi/soil_quality/soil_biology/soil_biology_primer.html>

Soil Central: CTAHR webpage with info on soils of Hawaii, soil fertility and chemistry information, soil testing, and other useful links. <www2.ctahr.hawaii.edu/ctahr2001/Soil/>

Plant Nutrient Management in Hawaii’s Soils. CTAHR publication containing practical research information on soils, fertilizers, and crop nutrient needs, written for the lay reader for Hawaii’s crops and soil conditions. $14. Available for purchase from CTAHR.

SOIL TESTING


CTAHR’s Agricultural Diagnostic Service Center (ADSC): This lab conducts plant disease analyses, feed and forage analyses, insect identification analyses, chemical analyses of soils, chemical analyses of plant tissue, and chemical analyses of water and nutrient solutions.

College of Tropical Agriculture and Human Resources
University of Hawaii at Manoa
1910 East West Road, Sherman Lab 134, Honolulu, Hawaii 96822
Ph: 808-956-6706 Fax: 808-956-2592
Email: adsc@ctahr.hawaii.edu
<www2.ctahr.hawaii.edu/adsc/>


COVER CROPS

Managing Cover Crops Profitably; USDA’s Sustainable Agriculture Network (SAN). An online pdf version of the book is available online and the second edition can be purchased (book $19, or CD-ROM $10). <www.sare.org/publications/covercrops/covercrops.pdf>

Sustainable Agriculture in Hawaii: Cover Crop and Green Manure Database at CTAHR provides information about plants which are suitable for tropical climates. Includes downloadable fact sheets. <www.ctahr.hawaii.edu/sustainag/Database.asp>
CROP KNOWLEDGE

GENERAL

UH College of Tropical Agriculture and Human Resources (CTAHR) has free and for sale publications with a wide range of information. Free publications include downloadable fact sheets on producing fruits and nuts, home garden vegetables, ornamentals and flowers, green manures and cover crops, insect pests, plant disease, weed control, and crop and soil management. For sale publications include production manuals for taro, coffee, tea, onions, corn, and lei plants. <www.ctahr.hawaii.edu/ctahr2001/>

CTAHR Ask the Experts Database (<http://pdcs.ctahr.hawaii.edu:591/ate/>) contains hundreds of questions and answers to a great variety of topics. It includes access points for CTAHR’s Publications Database, Knowledge Master (weeds, diseases, and pests), Pesticide Information Retrieval System (for commercial users of agricultural chemicals) and The Farmer’s Bookshelf (production information about many fruits, vegetables, ornamental plants, and home garden vegetables).

PEST MANAGEMENT

GENERAL


PESTICIDES

Pesticide Risk Reduction Education Program, University of Hawaii Cooperative Extension Service (<pesticides.hawaii.edu/epp/pat.html>). Contains on-line training manuals to prepare for pesticide certification exams.

INSECT MANAGEMENT

Extension Entomology & UH-CTAHR Integrated Pest Management Program. Knowledge Master contains general information on pest hosts, distribution, damage, biology, and management. This website is helpful for pest identification. The management recommendations are for conventional agricultural practices and will most likely need modification for sustainable systems. Contact CTAHR experts directly for more information. <www.extento.hawaii.edu/kbase/default.htm>

WEED MANAGEMENT


ORGANIC PRODUCTION RESOURCES

Hawaii Organic Farmers Association is a nonprofit organization that provides information and education, farm apprenticeship programs, and organic certification for Hawaii’s farmers. They sell a handbook that familiarizes beginning farmers with the federal rules on organic practices ($15).

Hawaii Organic Farmers Association (HOFA)
P.O. Box 6863, Hilo, HI 96720
Phone: (808) 969-7789 Toll Free: (877) 674-4632
Email: hofa@hawaiiorganicfarmers.org
www.hawaiiorganicfarmers.org/


Organic Materials Review Institute (OMRI) <www.omri.org/>

Organic Farming Research Foundation (OFRF) <www.ofrf.org/>
Organic Trade Association (OTA) <www.ota.com/index.html>


LOCAL ASSISTANCE

UNIVERSITY OF HAWAII COOPERATIVE EXTENSION SERVICE (CES)
To locate the CES office nearest to you, contact:

Cooperative Extension Service
3050 Maile Way, Gilmore Hall 203, Honolulu HI 96822
Tel: (808) 956-8397
Email: extension@ctahr.hawaii.edu
Website: <www.ctahr.hawaii.edu/ctahr2001/>

NATURAL RESOURCES CONSERVATION SERVICE (NRCS)
To located the NRCS office nearest to you, contact:

NRCS State Office
PO Box 50004, Honolulu HI 96850-0050
Tel: (808) 541-2600
Website: <www.hi.nrcs.usda.gov/>
CHAPTER 4

THE FARM AS HABITAT: ENVIRONMENTAL TOPICS
THE FARM AS HABITAT: ENVIRONMENTAL TOPICS

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Use this document in conjunction with the companion website:

Links for New Farmers
http://www.ctahr.hawaii.edu/sustainag/newFarmer/links.asp

hosted by the Sustainable Agriculture Program at the University of Hawaii College of Tropical Agriculture and Human Resources. Extensive additional information and updates are posted there.
THE FARM AS HABITAT: ENVIRONMENTAL TOPICS

Here in our islands of tropical paradise, the Honolulu Board of Water Supply routinely filters out pesticides and nitrates from several wells before delivering drinking water to our homes. The source of the pollution is publicly recognized: “chemicals found in some of Oahu’s Pearl Harbor wells are attributed to decades of pesticide and herbicide application from large-scale agriculture, such as pineapple and sugarcane.” Here researchers study how Hawaii’s children were affected by heptachlor epoxide, a pesticide residue from pineapple green chop fed to dairy cattle, tainting the local milk supply in the ‘80s. Hawaii is often referred to as the “endangered species capital of the world” with 317 threatened and endangered species in the state. Most of these bird and plant “survivors” now grow only in very remote areas.

In Hawaii, the impacts from agriculture on human health and the environment can be detected relatively quickly. Our small island ecosystems are swiftly altered by land use changes. Given our unique plantation history where sugar and pineapple dominated, daily we deal with the legacy of large scale chemical-based agriculture. And daily we continue to demand and consume agriculture’s food and fiber products.

Many of the laws which now govern agriculture were passed to correct these and other startling problems. These laws seek to protect and benefit the resources held in common by all the peoples of Hawaii, our water supplies, our streams and wetlands, our extraordinary plants and animals, and ultimately our health and quality of life.

Fortunately, the beginning farmer who has embraced sustainable agriculture will recognize and already be implementing many practices described later which protect Hawaii’s wealth ~ her natural resources.

HAWAII’S UNIQUE BIOLOGICAL HERITAGE AND NATURAL RESOURCES

Located 2500 miles away from the nearest continental landmass, the islands of Hawaii are some of the most remote on earth. The plants and animals now native to these islands arrived here originally by wave (swimming or on ocean currents), by wind (seeds and spores), or by wing (birds and one bat species). Each island was unique and provided the newcomers with a wide range of homes from which to pick. From cold, lofty mountain ranges to hot sunny coastlines, relatively free of disease pressures.
or predators, the birds and plants grew and evolved together. Each island came to host its own rare wildlife. Many of the plants and animals required each other for survival. As a result, 97% of our native species are found here and nowhere else on earth. Many of those habitats no longer exist or have been severely altered. Invasive weeds, introduced animals, insects, diseases and human land use changes threaten many species’ existence. Agriculture and forestry have played a major role in this story.

HAWAIIAN STREAMS

Our streams have three features which distinguish them from those on the U.S. mainland. Hawaiian streams are much smaller - only 28 of our streams are 10 miles or longer. They are fairly steep and characterized by waterfalls, especially on the younger islands (such as Hawaii Island). They tend to experience short but intense flooding as a result of localized heavy storms, giving them a “flashy” nature (as in the term flash flood).

Our aquatic animals evolved in response to these attributes. Because the Hawaiian archipelago is so isolated, only two fishes are endemic (found only here). One unusual little Hawaiian fish, the goby, developed a muscular fin, similar to a suction cup, adapted to hold on tightly to rocks during storm events and to climb up waterfalls.

There are five species of native stream fish (collectively known as ‘o’apu in Hawaiian). Four are endemic and one is indigenous (native to Hawai‘i and other locations). Native stream shellfish, all of which are endemic, consist of two crustaceans (‘opae), and three mollusks (hihiwai, hapawai).

Hawaiian fish require uninterrupted access to the full length of a stream system. They lay eggs in the upland (mauka) areas of the stream system. Upon hatching, the young migrate downstream (makai) and out to sea. They live in the ocean for a time and then return and migrate upstream. Stream channel alterations can interrupt this cycle. Man-made irrigation and stormwater systems have seriously harmed these unique Hawaiian stream animals.

HAWAIIAN WILDLIFE

As mentioned earlier, many of Hawaii’s native plants, birds, and insects are truly exclusive to our islands. Some are found on a single island, or in a single valley or hillside of a single island. Truly distinctive organisms, they are adapted to one place on earth.

Another distinguishing feature of our wildlife is that many of our birds and plants co-evolved, requiring each other for survival. There are many examples of native birds with bill structures shaped for pollinating native plants. Changes in the composition of the plant life (which provides food, shelter and habitat for birds) directly affect bird populations. The opposite is true as well. Certain native plants species have lost their pollinators and can no longer survive without man’s intervention.

Hawaii’s native birds and plants have always suffered from the
unintended consequences of man’s activities. Scientists believe that 35 bird species became extinct after the islands were settled by Polynesians. They blame vegetation changes from Polynesian agriculture plus the introduction of alien species such as pigs, dogs and rats. Further harm occurred when native forests were burned and cut to feed a voracious demand for sandalwood. The forests closest to Honolulu were completely consumed, trying to meet the fuel demands of the whalers. Foresters rushed to restore the forest canopy in the upper reaches of the watershed, importing new fast-growing tree species, often invasive ones. Ranchers raised cattle, goats and sheep on the islands, further damaging native plants with their hooves and browsing. Of Hawaii’s 317 threatened and endangered species, 273 are plants.

The Endangered Species Act applies to many plants and animals here in Hawaii. As a farmer, if you are managing property where these organisms live, you have certain limitations on what you can do. Funding is available to help you preserve habitat for endangered plants and animals. Some farmers are able to develop low impact ecotourism ventures to showcase these Hawaiian plant and animal treasures.

HAWAIIAN WETLANDS

In the past, wetland areas (swamps) were targeted for filling and draining so that they could become “productive,” which usually meant used for agriculture or housing or commercial buildings. As more and more wetlands disappeared, the folly of this policy became apparent. Flooding increased because wetlands which served as water storage areas during big storm events had disappeared. Water quality declined: nutrients and sediment in storm water were no longer being filtered and purified through the wetland areas. Fish and bird populations plummeted because nesting and spawning areas required for their feeding and breeding were dried up.

Hawaii was no exception. For example, there was once a large wetland area in Waikiki. The wetland was filled and the channel named the Ala Wai Canal. Today, water quality in the Ala Wai is some of the worst in the state. The U.S. Army Corps of Engineers has begun a major study to address flooding concerns for this watershed.

The remaining few wetlands in areas such as the Hanalei Valley, Kealia Pond, Kawainui Marsh, and the James Campbell Wildlife Refuge, are essential for the survival of endangered Hawaiian waterbirds. The crisis is so severe that funding is available for landowners to protect and expand wetlands areas on their property. Be aware of state and federal laws which restrict draining and filling of wetland areas on your property.

Some innovative mainland farmers view wetland wildlife as a marketing asset and highlight conservation efforts in their promotional materials. Certain consumers are willing to pay a price premium for products that are “environmentally-friendly.”
HAWAIIAN FORESTS

Without forests, we could not live in the Hawaiian Islands. Virtually all of our fresh water, including all drinking water, comes from the Hawaiian forest. The forest also provides us with a comfortable climate, clean air, recreation areas, plants of medicinal and cultural value, habitats for native species, and woods for commercial forestry and fine arts.

Although Hawaii is probably best known for its lush rain forests, the dry forests found mostly on leeward mountain slopes are also valuable and are in greater danger of extinction. Almost one-fourth of native Hawaiian plant species are found in these dry forests. An alarming 90 percent of Hawaii’s dry forests have been destroyed. What little habitat remains is highly fragmented.

Invasive plants, many of which have escaped from agricultural fields, pose a major problem for Hawaii’s forest resources.

GROUND WATER

Many Hawaii residents on O‘ahu and Maui get their water from underground aquifers. The deep volcanic-rock aquifer in central O‘ahu and Honolulu supplies more than 90 percent of the island’s public water supply. It is highly permeable and unconfined (except near the coast) making it vulnerable to contamination. U.S.G.S reports that contaminants found in untreated water on O‘ahu reflects the historical use of chemicals, and contains solvents (from military, urban and pesticide formulations), fumigants (from pineapple fields), and agricultural herbicides and fertilizers (from agriculture, parks, golf courses and urban areas). These chemicals persist for several decades. Some ground water must be treated to meet drinking water standards.

HAWAIIAN CORAL REEFS

On the mainland, people who work and manage the land tend to forget about their impact on ocean resources. This simply isn’t possible in our islands ~ the coral reef is central to our local lifestyle. Reefs protect and stabilize our shorelines from seasonal storm damage. Our white sandy beaches were formed from their coral. Our favorite surfing spots are created by the waves breaking over them. Subsistence, commercial and recreational fishermen harvest from the coral reef food chain.

Our marine life is distinct from that of the rest of the Indo-Pacific Ocean. About 25% of our reef fish and algae are endemic (only exist here). One of the most isolated places on earth, Hawaii is also one of the most populated, with 1.2 million inhabitants in close proximity to the coral reefs.

Wide-scale damage to the coral reefs began when livestock grazing and agriculture on O‘ahu, Maui, Moloka‘i and Lana‘i caused excessive erosion and sedimentation on fringing reefs. Dredging and filling for residential, commercial and military use further damaged them. Most recently, polluted storm water (overloaded with sediment and nutrients) from agricultural and urbanized streams have caused algae to overgrow the coral.
PROBLEM: SOIL EROSION

Soil erosion is a natural geological process - however accelerated soil erosion, exacerbated by man’s activities, is considered a form of pollution. For example, when suspended soil particles wash out to the ocean, smother reef organisms, and result in declines in fish populations, it is a cause for local concern. Nutrients or pesticides attached to soil particles contaminate streams and bays causing water quality problems. Streambank erosion from unwise land uses harm unique endangered Hawaiian stream animals (‘o’opu, ‘apae, and hiihiwai). These impacts have already been well documented throughout the islands of Hawaii.

Be aware of local grading ordinances which apply to farming and are designed to protect off-site areas from sedimentation. Farmers are responsible for the quality of the water leaving their property. You can be fined if the water is excessively turbid.

Fortunately farmers agree that the best place for soil is in the farmer’s field and topsoil is too valuable to allow off-site. There are many things the beginning farmer can do to prevent soil from moving off the farm by wind, water or gravity.

The Natural Resources Conservation Service is the nation’s main source of information about agricultural erosion control. All of their standards and specification information are available to the public in the form of an electronic field office technical guide (eFOTG) which can be accessed via the internet and as a written reference publication available at every NRCS Service Center.

Certain areas on your farm are more susceptible to erosion and will require extra erosion protection (or should be avoided for agricultural and ranching uses):
- Areas with steep slopes
- Areas with very erodible soils
- Areas where water channelizes across the property (waterways, streams, diversion ditches).

Erosion is more of a threat in regions with very heavy rainfall and during the rainy season.

HOW TO CONTROL SOIL EROSION
- Keep exposed bare soil to a minimum (through mulching, cover crops, buffers, filter strips, conservation tillage, riparian buffers).
- Reinforce areas where water channelizes (using grassed and lined waterways, streambank and shoreline protection).
- Use special measures on slopes (contour farming, terraces).
- Use special measures to limit wind erosion (wind barriers, wildbreaks, shelterbelts).
- Keep vegetated buffer strips between production areas and sensitive features on your property (such as streams, wetlands, wildlife habitat, etc).
O‘ahu, with its urbanization and large agricultural tracts, has the distinction within our state of having more than 30 streams that are considered “water-quality impaired,” primarily for exceeding state standards for nutrients and suspended sediment. Similar problems have been identified on Hawai‘i Island, Kaua‘i, Maui and Moloka‘i. Groundwater supplies under O‘ahu’s central plains have elevated levels of nitrate, attributed in part to over-fertilization of crops. High levels of nitrates in drinking water may affect infants by reducing the oxygen levels in blood, causing what is known as “blue baby syndrome.” Recent research at the University of Hawaii has documented widespread problems with excessive use of phosphorous fertilizers on Hawaii farms. This problem has been traced to using standard fertilizer formulations which over-apply unneeded nutrients.

**REDUCE FERTILIZER NUTRIENT POLLUTION**

- Base your fertilizer rates on crop needs and on soil and tissue testing results.
- Properly calibrate your equipment for accurate fertilizer application rates.
- Use fertilizer formulations to match your crop needs (rather than standard formulations that over-apply certain nutrients).
- Consider weather conditions before applying fertilizers. Don’t apply soluble fertilizers right before large storm events. Be more cautious during the rainy season.
- Increase organic matter to help retain nutrients in your soil.
- Leave unfertilized buffer areas along water bodies (streams, ponds, rivers, wetlands).
- Be very careful when applying nutrients on sandy soils (which tend to be more prone to leaching) and on shallow soils (over lava).
PROBLEM: NUTRIENT POLLUTION FROM MANURE

REDUCE NUTRIENT POLLUTION FROM MANURE

- Develop a nutrient management plan with assistance from USDA NRCS or Cooperative Extension.

- Locate manure storage areas away from wells, waterways, ocean, and public drinking water sources (legal setbacks apply).

- Install vegetated buffer strips between manure storage areas and sensitive rivers, streams and wetlands.

- Divert clean water away from manure storage areas.

- Test nutrients in manure to determine appropriate field application rates. Base your manure application rates on crop needs and on soil and tissue testing results.

- Don’t spread raw manure within 100 feet of streams and away from natural drainage swales. Incorporate the manure as soon as possible.

- Watch the weather to avoid spreading raw manure prior to storm events.

- Consider using rotational grazing pasture management to reduce waste problems.

- Consider composting to reduce the volume of manure, kill parasites, reduce odor, and produce a high value organic fertilizer and soil amendment.

- Organic farms can cause the same environmental problems as conventional farms. Environmental concerns associated with organic production practices may be related to:
  - The transition period from conventional to organic farming
  - Improper or incomplete nutrient management practices
  - Improper storage of manure or compost materials
  - Excessive tillage without adequate soil conservation measures
Pesticides can be dangerous chemicals and need to be used very carefully to protect farm families and workers, farm animals and native wildlife, and the general public. Much of pesticide applicator training involves understanding the health and environmental risks associated with pesticides and learning how to use them without endangering yourself and others.

Pesticides can move away from the farm field and cause health and environmental damage in several ways. They can be transported by air (drift) in the form of particles, droplets, and vapors carried by wind. Water can carry them off-site through leaching and runoff. Hawaii’s freshwater is especially vulnerable to contamination from pesticide leaching into the soil to the aquifers which we rely on for drinking water. Pesticides have also been discovered in Hawaii’s surface waters, carried by runoff into drainage ditches, to streams, ponds and the ocean.

Pesticide residues can also pose health and environmental problems. Persistent pesticides which take a long time to break down in the environment may subsequently harm people, plants and animals. The effects of bioaccumulation of pesticides within the bodies of animals and human beings is also of concern and being researched.

Certain areas are considered to be more sensitive to pesticide damage and require additional caution. These areas include:
- zones near schools, playgrounds, and hospitals
- areas where groundwater recharges (wells, sinkholes, gravelly and sandy soils)
- near surface waters (streams, rivers, wetlands)
- near endangered species habitats
- near apiaries, wildlife refuges or parks.

Pesticide labeling should alert you to concerns in these sensitive areas.

**SUSTAINABLE AGRICULTURE PRACTICES FOR PESTICIDE USE**
- Use pest control strategies outlined in Chapter 3 to help keep your use of pesticides low.
- Get pesticide applicators training from the University of Hawaii Cooperative Extension Service Pesticide Risk Reduction Education Program.
- Read pesticide labels and apply them strictly according to instructions (using protective equipment, correct mixing rates, calibrated sprayer, etc.). The label is the law.
- Mix and load pesticides in an appropriate area (concrete, located away from streams, wetlands, and wells).
- Leave an unsprayed buffer strip area along streams and wetlands.
- Store pesticides in a safe area.
- Dispose of pesticides and their containers safely.
**PROBLEM: INVASIVE SPECIES AND NOXIOUS WEEDS**

One of the major threats to Hawaii’s forest, agricultural and livestock industries is the spread of aggressively growing plants across the state. Whether they are termed “noxious weeds” by Hawaii’s Dept. of Agriculture or “invasive plant species” by the Dept. of Land and Natural Resources, these organisms possess growth characteristics that allow them to outcompete and overwhelm our native forest and agricultural crop species.

Many of these plants possess a climbing or smothering growth habit and can virtually choke out shrubs and trees. They may be nitrogen-fixers, meaning that they can survive well in low fertility soils. They tend to be extremely prolific, quickly producing prodigious supplies of seeds or spores. Their seeds and spores can be easily dispersed by animals such as birds and pigs, or by our tradewinds. They are very fast growing and quickly gain dominance in the search for light, water, food and space.

How did they arrive here? In the past, most of these plants were introduced to our islands by well-meaning foresters, farmers, and horticulturalists. The ornamental plant trade accounts for an estimated 90% of invasive plant introductions to Hawaii. Among the more serious ones currently wreaking havoc are gorse, banana poka, miconia, and ivy gourd.

Plants are not the only invasive species which are arriving at our shores. Scientists and land managers continue to be plagued by notorious amphibians such as coqui frogs, or stinging insects like the red imported fire ant. The Dept. of Agriculture maintains a pest advisory website to help farmers be on the lookout for the latest alien invaders.

How do they get here? These creatures can stow away in a cargo container, be sent to you through the mail, or be carried by your auntie from a neighbor island by plane, hidden on a plant or flower.

**CONTROL INVASIVE SPECIES**

- Stay up to date on the current invasive species of concern (HDOA Pest Advisories, DLNR & DOH).
- Don’t delay in reporting sightings of new plants and animals.
- Be cautious when ordering plant materials by catalogue. Before you buy, check the plant in the weed risk assessment website to see if it has been ranked as a pest species.
- Respect the importance of having plant materials screened through the Dept. of Agriculture declaration forms and checkpoints. They are there to protect Hawaii agriculture!
- Apply the sustainable pest management strategies described in Chapter 3 to prevent the spread of pests and to keep pest populations low.
Livestock producers in Hawaii have made major changes in the way they do business in recent years, largely in response to health and environmental concerns. If not carefully managed, animal production has the potential to negatively affect surface water quality (from pathogens, phosphorus, ammonia, and organic matter); groundwater quality (from nitrate); and air quality (from odors, dust, pests, and aerial pathogens). Allowing cattle to water and graze in riparian (stream) areas can result in loss of vegetative cover (due to consumption or trampling), additions of fecal matter and nutrients, and stream bank erosion.

At the same time, raising animals can complement many small farming operations and diversify income sources. Some farmers use chicken or geese for chemical-free insect or weed control. Larger grazing animals can be used to control invasive weed species such as California grass. Their manure improves the soil by providing nutrients and organic matter.

Innovative farmers and ranchers are trying management methods such as rotational grazing and pasturing poultry and hogs to keep their neighbors happy, their water resources clean, and their profits up.

**SUSTAINABLE LIVESTOCK MANAGEMENT**

- Locate animal housing, pens, stables, corrals and exercise yards away from wells, waterways, ocean, and public drinking water sources (legal setbacks apply).

- Divert clean water away from pens, barns, corrals, and exercise areas.

- Consider using rotational grazing pasture management to reduce waste problems.

- Leave untouched vegetated buffer areas along water bodies (streams, ponds, rivers, wetlands).

- Dispose of dead animals appropriately.

**PROTECT RIPARIAN (STREAM) AREAS**

- Fence livestock out of sensitive riparian (stream) areas.

- To prevent erosion, provide appropriate reinforced stream crossing areas.

- Provide animals with alternate water sources.
PROBLEM: LOSS OF WILDLIFE HABITAT

PROTECT HAWAIIAN PLANTS
Endemic plants are native to Hawai‘i and found nowhere else in the world.
- Grow native trees, shrubs and other plants on your property wherever feasible.
- Never harvest endangered plants from the wild (many are now commercially available). The market for commercially produced native plants for residential and commercial landscapes and government-mandated restoration projects is growing.
- Don’t plant a pest. Invasive alien plant species displace Hawai‘i’s distinctive native flora that support a large array of unique native plants and animals.

As a water source, streams and wetlands always attract wildlife. 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 Hawai‘i’s endangered aquatic animals and water birds.

PROTECT HAWAIIAN STREAM ANIMALS
- Maintain natural water flow levels in streams.
- Don’t alter stream channels from mountain to the sea.
- Prevent toxic chemicals (such as pesticides) and nutrients (from fertilizer or manure) from entering streams.
- Grow vegetated buffer strips of native plants suited to your area along streams to keep stream water shaded, clear and clean.
- Don’t release exotic fish, invertebrates (snails, crayfish, shrimp), or aquatic plants into streams and wetlands. It’s against the law.

PROTECT HAWAIIAN WETLAND ANIMALS
- Grow vegetated buffer strips of native plants suited to your area along wetlands.
- Prevent toxic chemicals (such as pesticides) from entering wetlands.
- Don’t dump trash in streams or wetlands. Stop other people who do.
- Stay away from stream and wetland areas during the breeding season.
- 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.
- Work with your neighbors and conservation agencies to provide a safe wildlife corridor along streams and wetlands. Native birds cannot survive without humanely trapping and removing mongoose and feral animals.

Montane Wetland Restoration for Hawaiian Duck

In 1998, NRCS signed up 3 large landowners on the Big Island for the Montane Wetland Restoration for Hawaiian Duck project. The project entailed restoration and development of wetlands for koloa duck on Parker Ranch, Umikoa Ranch, and Chalan International lands on the Island of Hawaii. NRCS partnered with Ducks Unlimited for financial and technical assistance.
The USDA Natural Resources Conservation Service (NRCS) can provide technical assistance and information about federal cost share programs which assist farmers with conservation efforts of their farms.

- The Environmental Quality Incentives Program (EQIP) is used to implement conservation practices to address statewide natural resource concerns of animal waste management, sedimentation and erosion, noxious weed control, and water quality and quantity.

- The Wildlife Habitat Incentive Program (WHIP) helps landowners to develop and improve wildlife habitat on private lands. In Hawaii, special emphasis is placed on native forest lands, endangered species habitats, and taro lo‘i restoration.

- The Wetland Reserve Program (WRP) helps landowners and leasees restore, enhance or create wetlands on agricultural lands.

- The Grassland Reserve Program (GRP) helps landowners to restore and protect grassland, including rangeland and pastureland, while maintaining the areas as grazing lands.

US Fish and Wildlife Service (Pacific Islands Ecological Services Conservation) administers the Private Stewardship Grant Program (PSGP), a national program that provides conservation funding on a competitive basis to individuals and groups engaged in private, voluntary conservation efforts that benefit species that are endangered, threatened, candidates, or species of concern on private lands.

The State of Hawaii Dept. of Land and Natural Resources (DLNR) sponsors a similar program, the Hawaii Landowner Incentive Program. Private landowners, individually or as a group, are encouraged to submit project proposals for their properties.

The investments which you make in conservation efforts on your farm may expand opportunities for Eco-Tourism. By starting out small, perhaps with a Bed-and-Breakfast and guided nature walks, you may be able to diversify your income sources. For additional information, refer to the resources section at the end of this chapter as well as the ag-tourism section in chapter 2, Direct Marketing.
RESOURCES AND RECOMMENDED READING

COMPANION WEBSITE
Use this document in conjunction with the CTAHR website Links for New Farmers. Additional information and updates are posted there.
<www.ctahr.hawaii.edu/sustainag/newFarmer/links.asp>

TECHNICAL ASSISTANCE
U.S.D.A. Natural Resources Conservation Service (NRCS)
To locate the NRCS office nearest to you, contact:
NRCS State Office
PO Box 50004, Honolulu HI 96850-0050
Tel: (808) 541-2600
Website: www.hi.nrcs.usda.gov
All NRCS standards and specifications for conservation practices are available to the public in the form of an electronic field office technical guide (eFOTG) which can be accessed via the internet. Section IV contains standards and specs.

POLLUTION CONTROL
ATTRA: Protecting Water Quality on Organic Farms
<attra.ncat.org/attra-pub/organicmatters/om-waterquality.html>

ATTRA: Constructed Wetlands
<attra.ncat.org/attra-pub/wetlands.html>

ATTRA: Protecting Riparian Areas: Farmland Management Strategies
<attra.ncat.org/attra-pub/managedgraze.html>

ATTRA: Managed Grazing in Riparian Areas
<attra.ncat.org/attra-pub/managedgraze.html>

Hawaii Pollution Prevention Information (HAPPI) Farm Series. Free downloadable fact sheets prepared by CTAHR about minimizing pollution from farming.
- Water quality and your farm—Introduction to the HAPPI-Farm series
- Mapping your farm to identify pollution risks
- Minimizing pollution risk from land management
- Minimizing pollution risk from nutrient management
- Minimizing pollution risk from pest management
- Minimizing pollution risk from irrigation management
- Minimizing pollution risk from livestock operations
- Minimizing pollution risk from pasture management
- Minimizing pollution risk from storage and disposal of chemicals and fuel
- Minimizing pollution risk from forest and streamside areas management
<www2.ctahr.hawaii.edu/ctahr2001/PIO/FreePubs/FreePubs04.asp>

CTAHR’s Agricultural Diagnostic Service Center (ADSC): This lab conducts plant disease analyses, feed and forage analyses, insect identification analyses, chemical analyses of soils, chemical analyses of plant tissue, and chemical analyses of water and nutrient solutions. College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa, 1910 East West Road, Sherman Lab 134, Honolulu, Hawaii 96822. Ph: 808-956-6706 Fax: 808-956-2592 Email: adsc@ctahr.hawaii.edu <www2.ctahr.hawaii.edu/adsc/>

PESTICIDE POLLUTION
University of Hawaii Cooperative Extension Service Pesticide Risk Reduction Education Program to download or purchase study packets. <pesticides.hawaii.edu/epp/pat.html>
INVASIVE SPECIES AND NOXIOUS WEEDS

**Hawaii Ecosystems at Risk Project** [http://www.hear.org/]

**Weed Risk Assessments for Hawaii and the Pacific**
[http://www.botany.hawaii.edu/faculty/daehler/wra/]

**HDOA Pest Advisories**
[http://www.hawaiiag.org/hdoa/pi_pa.htm]

**CONSERVATION FUNDING RESOURCES**
For information about the Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentive Program (WHIP), Wetland Reserve Program (WRP), and the Grassland Reserve Program (GRP), contact the **U.S.D.A. Natural Resources Conservation Service (NRCS).** To locate the NRCS office nearest to you, contact:

NRCS State Office
PO Box 50004, Honolulu HI 96850-0050
Tel: (808) 541-2600
Website: www.hi.nrcs.usda.gov

**US Fish and Wildlife Service** (Pacific Islands Ecological Services Conservation) **Private Stewardship Grant Program.** [pacificislands.fws.gov/worg/orghc_conpart.html]

**State of Hawaii Dept. of Land and Natural Resources** (DLNR) **Hawaii Landowner Incentive Program.** [www.state.hi.us/dlnr/dofaw/LIP/]

**ECO-TOURISM**

**Making Nature Your Business: Planning and Developing a Nature Tourism Enterprise**
[www.tpwd.state.tx.us/nature/tourism/your_business/planning.phtml]

**Agricultural Marketing Resource Center (AgMRC): Nature Based Tourism:** Links to on line manuals and success stories on eco-tourism.
[www.agmrc.org/agritourism/naturebased.html]

**Nature-based Tourism Enterprises. Guidelines for success** (pdf), Clemson University. Topics covered in this online document include planning and development, defining your service, start-up costs, administration, operations, creation of an Internet presence and marketing. 2000
[www.strom.clemson.edu/publications/Potts/nbt2000.pdf]
CHAPTER 5

ANIMAL PRODUCTION
ANIMAL PRODUCTION

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Use this document in conjunction with the companion website:

Links for New Farmers
http://www.ctahr.hawaii.edu/sustainag/newFarmer/links.asp

hosted by the Sustainable Agriculture Program at the University of Hawaii College of Tropical Agriculture and Human Resources. Extensive additional information and updates are posted there.
ANIMAL PRODUCTION

With each wave of immigrants to reach these remote islands, people have brought with them their favorite beasts. Whether pigs transported in Polynesian voyaging canoes, black longhorn cattle or axis deer gifted to King Kamehameha, or domesticated sheep and goats introduced by European settlers, most of these animals are now part of our local culture, history and economy. Some of these “buggahs” have escaped from their pens and become environmental terrors ~ but more on that in chapter 4. The fact remains, we like our animals. Every day the peoples of Hawaii eat and use products derived from these animals. Some are even able to manage their livestock in ways which help reduce human drudgery.

On the farm or within a grassland ecosystem, plants and animals tend to complement each other. Ruminants (such as cattle, sheep, and goats) can convert plant fiber which is indigestible to humans, into meat, milk, wool, and other valuable products. Domesticated birds scavenge for insect delicacies, reducing insect pest pressures on crops. Animal manure fertilizes and increases organic matter within the soil, restoring nutrients into the crop or pasture system. Some innovative farmers have their animals to do their dirty work – using pigs to turn compost or ducks to clip weeds. The art and science of managing these plant and animal interactions is a big challenge for any new farmer to learn.

IS THIS REALLY FOR YOU?

Unlike crop production where a plant can be ignored for a while without mishap, caring for livestock is a 365 day-a-year job requiring a much higher investment of time. Before starting your livestock enterprise, you’ll need to do extensive research. Be sure to investigate the following issues before you make your final decision about getting into the business.

Legal Restrictions: First determine if your property is zoned to allow domestic livestock agriculture. Generally you can find this information at your county planning department. Learn about other regulations which affect your livestock operation such as required legal setbacks to dwellings and wells, restrictions for barns and fencing, and nuisance laws regulating noise, dust, odor or flies.

Feed: Understand the nutritional needs of the animals you want to raise. This will differ greatly from one animal to another based on their size and digestive systems. Food requirements also vary due to climate, the time of year, and the production stage of the animal (growing, breeding, pregnant, lactating, dry).

Your decision about which animals to raise will partly be based on the volume of feed they will consume. You’ll need to assess

HAWAII’S PANIOLO: A PROUD CULTURE

The first cattle arrived in Hawaii in 1793, a gift of five longhorns to King Kamehameha I delivered to the Big Island of Hawaii. The King placed a taboo on slaughtering the cattle and they thrived. By 1832 wild cattle had grown too numerous, becoming a problem. King Kamehameha III arranged to have three Mexican cowboys come to help thin the herds. Hawaiians quickly learned from the Mexican cowboys how to ride horses, rope and tame the wild cattle, becoming known as “paniolos.” When Waimea’s Ikua Purdy won the World Rodeo Championship in 1908, the Hawaiian paniolo received world wide recognition for their skills. The slack key guitar style was also created by the Hawaiian paniolos.
your ability to pay for feed or to produce it.

Generally, feed is purchased or cut and fed. In Hawaii, transportation costs tend to make feed costs higher than for mainland competitors. Get a good handle on what your feed costs will be and how they will vary before getting into this business.

If you have access to land, forage from pasture or from orchard groundcover may be an option available for grazing livestock. Several factors determine how much forage the land can produce – climate, topography, soil type and fertility, irrigation availability, and the grazing management system which you use. Pastures can be improved through fertilization, weed control, pasture renovation and reseeding. Consult with your local Cooperative Extension agent to determine how much forage your land can produce. Consider selecting breeds best adapted to your climate and grazing system.

Although most ranchers employ continuous grazing systems, there is another management option known as rotational grazing. In this system, pastures are subdivided into paddocks and animals are moved through these paddocks at frequent intervals, allowing them access to a limited pasture area for a short period of time. This idea is being adapted to other species as well, engendering a market for “pastured” pigs and poultry.

Water Supply: Project how much water your livestock will need, realizing that their water requirements will vary by species, breed, animal age, time of year, and climate. Research and plan how you will get them water.

Some options may include:

- Hauled water: This can work well for rotational grazing schemes. Move the water source within the pasture to distribute animal damage and manure.

- Pipeline systems: A pumping system can be solar, wind, gas/diesel powered or gravity-fed to troughs and tanks. Animal operated pumps (such as nose pumps and nipple waterers) are also available.

- Stream or Pond: Livestock tend to damage stream banks with their hooves, defecate in the water, and consume streamside plants. To protect riparian areas, control and limit livestock access to streams and build a stable (gravel) livestock access area. (USDA cost sharing funds are generally available for stream protection measures.)

- Springs: If there is a spring on the property, determine if you are legally allowed to use it for a livestock water supply. Test the water to check for contamination.

Shelter: Animals require housing to provide shade and to protect them from wind and rain. These structures range from modest simple pole structures to full-scale stylized barns. Portable shelters

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**Monogastric animals** (pig, fish, dog) must consume high quality balanced diets. Swine need a high energy, concentrated grain diet low in fiber (cellulose) and supplemented with adequate protein. The avian monogastric digestive system (poultry) differs because they have no teeth. Feed rations will vary for meat or egg production.

**Nonruminant herbivores** (horse, rabbit, guinea pig, hamster) need less roughage, more and higher quality protein and added vitamins.

**Ruminants** (cows, goats, sheep, elk, deer, bison, llamas and alpacas) have complex multi-chambered stomachs with microorganisms in the chambers which convert cellulose into energy. They can process large quantities of bulky forages to provide their nutrients.
are very practical for avoiding buildup of manure and urine and in rotational grazing systems. Before you build, take into consideration installation, cost, appearance, longevity, and maintenance factors. Standard plans for livestock shelters are available for purchase and on-line.

**Space:** Determine the space requirements of the animals you plan to raise. If you need to erect fencing, consider the advantages and disadvantages of each kind of fencing, installation, cost, appearance, safety, longevity, and maintenance issues.

**Health Care:** Consult a local veterinarian to understand the health care requirements and expenses for your livestock. Be aware that internal and external parasites pose a serious concern in the tropics and sub-tropics. Establish an antihelminthic program for your livestock. Health care also includes preventative measures such as proper nutrition, maintaining vaccinations, record-keeping, and quarantining new animals. Become informed about local toxic weeds which can harm your animals.

**Predator Control:** Sheep and goats are vulnerable to dog predation. Poultry and waterfowl are subject to predation by cats, mongoose, owls and hawks. A good perimeter fence line will protect your livestock. In some cases an additional low electric fence may be required to prevent dogs from digging below the main fence.

**Manure:** One of the most time consuming aspects of livestock production, manure management, is the single aspect of your operation most likely draw complaints. If you’re not familiar with this aspect of animal husbandry, it’s hard to imagine ahead of time just how much manure you’ll be handling. Before going any further with your plans, work with local agricultural professionals to develop a good estimate of how much manure your new livestock operation will produce.

Good manure management will keep your livestock healthy, return nutrients to the soil, improve pastures and cropland, and protect the environment. Poor manure management will increase insect and parasite populations that can get your livestock sick and will generate angry phone calls from your neighbors. Part of the nutrient and bacterial contamination observed in Hawaii’s surface and ground water can be traced to inadequate manure management.

You will need to address how to collect, store, remove and/or apply manure. The Cooperative Extension Service and the USDA Natural Resources Conservation Service have extensive resources and information about manure management options. Many farmers use their manure on-site to improve soil fertility. New partnerships are emerging between livestock and crop producers to recycle surplus manures back to neighboring farm fields. Also there is a growing market for composted manure by gardeners, landscapers and farmers.

**Composting** may be an excellent option for managing your manure. A good composing operation will reduce the volume of

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**Grazing Livestock under Orchards**

More frequently chickens, geese and sheep are now seen grazing beneath trees in Hawaii’s coffee, mac nut and fruit orchards. Farmers are taking advantage of natural plant-animal relationships by growing nutritious grasses and legumes in their orchards. In addition to providing erosion control and weed suppression, these groundcovers are selected to provide forage for livestock. The livestock provide a secondary income source for the farm.
manure, kill parasites, reduce odor, and result in an excellent soil amendment. Since composting is a biological process which relies on living microorganisms, you’ll need to learn how to manage compost piles to obtain optimal temperatures, correct carbon to nitrogen ratios, and adequate oxygen and moisture content. Sales of a high quality compost product can help you generate revenue from a waste product.

**On-farm Processing and Slaughterhouses:** Before you enter this business, it’s best to consider your slaughterhouse and processing options early on. Often it’s difficult to locate commercial processors that handle small numbers of animals. If you don’t get too queasy about the thought of killing, plucking, skinning and gutting, on-farm processing may be an option. Be aware that there are strict federal processing regulations. Small independent producers may be exempt from federal inspection rules – but be sure you do your research ahead of time. Designs for small on-farm abattoirs and mobile abattoirs are available.

**STARTING SMALL**

If you haven’t worked with animals, a new farmer should begin with a small scale facility and gain some experience with smaller animals which are generally less expensive to purchase and require less space to manage. Additional sources of information about raising these animals are available at the end of this chapter.

**POULTRY**

The low investment and small area required to raise a flock of domestic poultry makes this a sound venture for the beginning farmer. Domestic poultry can supplement the family menu, as well as generate several niche products. For example, producers can sell free-range or organic meat and eggs, brown eggs, live birds for ethnic markets, and birds for hobby and leisure.

**Pastured poultry** (or free-range poultry) is a growing niche market that taps into consumer demand for more natural and humanely raised protein sources. Consumers who purchase this poultry product are generally willing to pay more for the system that includes raising poultry on grassy pasture. The product is considered by many consumers to be healthier and tastier, as well as more environmentally sound.

Another growing niche market is for “designer eggs” – eggs with higher concentrations of vitamin E or Omega-3 fatty acids. By modifying the diet of laying hens, farmers can produce eggs that contain significantly more Vitamin E and omega-3 fatty acids than ordinary eggs. “Free range” and “organic” eggs are also enjoying growing popularity.

**SWINE**

You can’t have a lu’au without a pig. The “pu’a’a” (Hawaiian for pig) has both traditional and contemporary value within Hawaiian culture (as well as within other Pacific and Asian cultures of Hawaii). Chinese and Hawaiians demand “hot pork” killed within
12 hours for its flavor. Local production for swine cannot meet the current demand so Hawaii imports most of its pork.

Raising swine on the small farm (3-5 acres) is common in Hawaii and fairly easy to do. Pigs can be fed imported feed or food, but they are most valuable for recycling food and agricultural waste products (such as food scraps and cull macadamia nuts, fruits and vegetables). To avoid odor complaints, consider using a deep litter system which has worked well in Hawaii and the Pacific.

**RABBITS**

With a minimum investment, relatively limited space, and a modest investment of labor, beginning farmers can start raising rabbits for meat and for the pet market. In Hawaii, locally raised rabbit meat can be found at grocery stores. Pet rabbits are especially popular around Easter and Christmas.

**GOATS**

In Hawaii there is a market for goat meat within the Filipino community. Other ethnic groups celebrate weddings and commemorate religious feasts with goat meat. All locally produced goat milk and cheese products are currently being sold, primarily as high value products to hotels.

**HORSES**

While it is not uncommon for farmers to keep a few horses, they are usually pets and used for pleasure or more recently for ag tourism. Some innovative farmers may board or breed pet horses, exotic horses, work horses, miniature horses or race horses.

**CATTLE**

Beef or dairy cows may be kept on farm for family use or for income. Today’s paniolo may also work with special breeds of cattle being introduced for new niche markets. Belgian blues, huge animals with good meat flavor and leanness are now being raised on the Hawaiian range. Smaller breeds such as the Dexter can also be found.

The beef and dairy industries in Hawaii are very competitive and are experiencing significant pressure and competition from mainland and international producers. Dairy and beef production are beyond the scope of this publication.

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**Be a good neighbor**

- **Obey zoning restrictions.** Raise animals where you’re allowed to.
- **Manage manure well.** Good manure management operations will have little odor and flies. Be sure your livestock is not the source of other pests (mosquitoes, gnats, fleas, ticks, lice).
- **Prevent runoff problems.** Use measures to prevent soil and manure from leaving your farm during heavy precipitation.
- **Protect groundwater.** Be sure you’re not overstocking animals and causing a pollution problem.
- **Control dust.** It’s harmful to your animals’ health and will irritate the neighbors. Use good sod or pasture management.
- **Keep down the noise.** Locate your animals away from your neighbor’s bedroom windows.
- **Keep your operation neat.** Use paint and landscaping to keep your farm attractive.
- **Visit your neighbors and explain what you’re doing.** Invite them to visit you and your farm.

Adapted from the *Small Farm Handbook*

University of California

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Photo by Mike DuPonte
RESOURCES AND RECOMMENDED READING

COMPANION WEBSITE
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<www.ctahr.hawaii.edu/sustainag/newFarmer/links.asp>

MANURE MANAGEMENT

**ATTRA: Manures for Organic Crop Production**
<attra.ncat.org/attra-pub/farmcompost.html>

**ATTRA: Farm-Scale Composting Resource List**
<attra.ncat.org/attra-pub/farmcompost.html>

COMPOSTING RESOURCES

**On-Farm Composting Handbook** (NRAES-54). 1992 by NRAES (Natural Resource, Agriculture, and Engineering Service). All rights reserved. For more information, please contact NRAES, (607) 255-7654, or nraes@cornell.edu. <www.nraes.org/publications/nraes54.html>

**Composting Resources: A Series.** 3-tape video series. The programs cover the benefits and costs of agricultural composting, ongoing research, and include practical farmer interviews. To order send $10 plus s/h to Agricultural Education & Extension Education, Video/Distance Learning Group, P.O. Box 442329, University of Idaho, Moscow, ID 83844-2329; (208) 885-7985.

COST-SHARE ASSISTANCE

**The USDA NRCS Environmental Quality Incentives Program (EQIP)** provides financial and technical assistance to farmers and ranchers who install conservation practices to address animal waste management and insufficient water supply for livestock. Contact your local USDA Natural Resources Conservation Service Field Office or check their website: <www.hi.nrcs.usda.gov>

POULTRY

**American Pastured Poultry Producers Association**, APPPA, P.O. Box 1024, Chippewa Falls, WI 54729; (715) 577-5966; Email: grit@apppa.org; Website: <www.apppa.org>


**Profitable Poultry: Raising Birds on Pasture**: This Sustainable Agriculture Network (SAN) bulletin features the latest research in a new “how-to” guide to raising chickens and turkeys using pens, movable fencing and pastures plus farmer experiences. <www.sare.org/publications/poultry.htm>

University of California, Agriculture & Natural Resources (ANR)

**Swine**

*Profitable Pork: Strategies for Hog Producers*: This Sustainable Agriculture Network (SAN) bulletin showcases examples of alternate ways to raise pork profitably — in deep-straw bedding, in hoop structures and on pasture.

**What do you need to raise pigs?** by Dr. Halina M. Zaleski (8/28/2002), University of Hawaii Swine Extension Specialist. <www2.hawaii.edu/~halina/432/swinestart.pdf>

**Rabbits**

University of California, Agriculture & Natural Resources (ANR)

<anrcatalog.ucdavis.edu/index.ihtml>

**Goats**

American Cheese Society, 34 Downing St. New York, NY 10014; (212) 727-7939. A non-profit organization for the promotion of natural specialty cheeses.

University of California, Agriculture & Natural Resources (ANR)

<anrcatalog.ucdavis.edu/index.ihtml>

**Sheep**

University of California, Agriculture & Natural Resources (ANR) Catalogue

<anrcatalog.ucdavis.edu/index.ihtml>


**Exotics**

ATTRA: *Ratite Production: Ostrich, Emu and Rhea* <attra.ncat.org/attra-pub/ratite.html>

American Ostrich Association, PO Box 163, Ranger, TX 76470 <www.ostriches.org>

American Emu Association, PO Box 224, Sixes, OR 97476 <www.aea-emu.org>

**Grazing and Rangeland Management**

Grazing Livestock Under Orchards by Glen Fukumoto, CTAHR

<www.ctahr.hawaii.edu/ctahr2001/InfoCenter/Forages/extensionResearch/GrazingUnderOrchards.doc>


