Chapter 1

Getting Sweet on Building Your Own Beehives

In This Chapter

- Getting the scoop on bees and their lives
- Seeing the advantages of building (versus buying) hives
- Planning your beehive build
- Putting together the right workspace, tools, and materials
- Honing your woodworking skills
- Digging into beehive designs

My backyard beekeeping adventure started in 1983, and I've never ceased to be amazed by these endearing creatures — the profound contribution they bring to gardening and agriculture through their pollination services; their remarkable social and communication skills; and, of course, that wonderful bonus of a yearly harvest of pure, all-natural, delicious honey. It's no wonder that beekeepers speak with such warmth about their *girls*.

As a beekeeper, it doesn't take long to expand the scope of your hobby into related beekeeping adventures, such as candle making, mead brewing, and a host of other honeybee-related activities. And if you have even a remote interest in woodworking and building things, it's only natural to want to learn how to build a home for your beloved bees.

In this chapter I include some information to help you get ready for building your own beehives and accessories. I start with Honeybees 101 — a mini review of the bountiful bee and what goes on inside a beehive. Then I turn to some ideas for setting up your beehive-making shop, fine-tuning your woodworking skills, and deciding which of the plans in this book best meet your needs and skills.

Bee-ing in the Know about Bees

So you want to build some hives for your precious bees? You're going to have fun! You have many options regarding the hives you can build, but before you dig in, it's helpful to understand a little bit about these extraordinary creatures.

Why honeybees are great pollinators

Honeybees can outperform all other types of pollinators in nature for a number of reasons.

- The honeybee's body and legs are covered with branched hairs that effectively catch and hold pollen grains. When a bee brushes against the stigma (female part) of the next flower she visits, some of the pollen grains from the previous flower are deposited, and the act of cross-pollination is accomplished.
- Unlike other pollinating insects that lie dormant all winter and then emerge in the spring in very small numbers, the honeybee colony overwinters, with thousands of bees feeding on stored honey. Early in the spring, the queen begins laying eggs, and the already large population explodes to many tens of thousands of bees that carry out pollination activities.
- The honeybee tends to forage on blooms of the same kind, as long as they're flowering, versus hopping from one flower type to another. This single focus makes for particularly effective pollination.
- The honeybee is one of the few pollinating insects that can be introduced to a garden at the gardener's will.

Honeybees' most important job: Pollination

Honeybees are a critical part of the agricultural economy. They account for more than 80 percent of all pollination of crops. In fact, honeybees pollinate more than 100 cultivated crops, including various fruits and vegetables, nuts, herbs, spices, and numerous ornamental plants. According to the agriculture department at the University of Arkansas, honeybees add an estimated $15 billion to the U.S. economy each year in increased crop yields.

Since 2006, the population of honeybees has been dwindling at an alarming rate. The reasons for this die-off of colonies are not yet fully understood at the time of this writing. But the consequence is laser-sharp. A spring without bees would seriously endanger our food supply. Building hives and establishing some colonies of bees in your neighborhood makes an important contribution to reintroducing pollinating bees to your neck of the woods.

The products of the honeybee

In addition to the wonderful pollination services that honeybees provide (see the preceding section), they produce products that you can harvest and put to all kinds of uses. These products include

- **Beeswax:** Honeybees secrete wax from eight glands located along their abdomen. They use beeswax to build the hexagonal cells in which they raise their brood and store their honey and pollen. You'll probably get several pounds of surplus wax for every 100 pounds of honey that you harvest. You can clean and melt down this wax for all kinds of uses, including candles, furniture polish, and cosmetics. Pound for pound, wax is worth more than honey, so it's definitely worth a bit of effort to reclaim this prize.

In this book, the Kenya top bar hive and the Warré hive (see Chapters 5 and 8, respectively) give you a lot of beautiful wax because, with these particular hives, you remove and crush the honeycomb to harvest your honey. To render the wax you collect from your hives, use a solar wax melter (see Chapter 16 for instructions on how to build one).

- **Honey:** Bees use honey as food, just like humans do. It's their carbohydrate. For people, eating local honey is said to relieve the symptoms of pollen-related allergies.

  There's something magical about bottling your own honey, and I can assure you that no other honey tastes as good as the honey made by your own bees. How much honey can you expect? The answer to that question varies depending on the weather, rainfall, and location and strength of your colony. But producing 40 to 80 pounds or more of surplus honey per hive isn't unusual.

  In this book, the best hives for producing copious amounts of the precious liquid gold include (in potentially dwindling order of abundance) the Langstroth hive (see Chapter 10), the British National hive (see Chapter 9), the Warré hive (see Chapter 8), and the Kenya top bar hive (see Chapter 5).

- **Pollen:** Bees use pollen like they use honey — as food. And why not? Pollen is one of the richest and purest of natural foods, consisting of up to 35 percent protein and 10 percent sugars, carbohydrates, enzymes, minerals, and vitamins including A (carotenes), B1 (thiamin), B2 (riboflavin), B3 (nicotinic acid), B5 (panothenic acid), C (ascorbic acid), and H (biotin).

  You can harvest pollen from your bees using a pollen trap (they're available from any beekeeping supply house). You can sprinkle a small amount on your breakfast cereal or in yogurt (as you might do with wheat germ). I like to sprinkle some on salads as a colorful addition. It's said that eating a little local pollen every day can relieve the symptoms of pollen-related allergies. When you have your own beehives, all-natural allergy relief is only a nibble away! Both the British National hive (Chapter 9) and the Langstroth hive (Chapter 10) lend themselves to effective pollen harvesting, as these are the hive types for which commercially made pollen traps are available.

- **Propolis:** Sometimes called *bee glue,* this super-sticky, gooey material is gathered by bees from trees and plants. The bees use this brown goop to fill drafty cracks in the hive, strengthen comb, and sterilize their home. Propolis contains vitamins, minerals, amino acids, and flavonoids that are said to promote anti-inflammatory, antioxidant, and antibiotic properties. You'll see a number of products in health food stores that contain propolis — everything from toothpaste to emollients to cough drops. You can harvest propolis from any of the hives in this book by simply scraping it off of the hive surfaces with your hive tool. In addition, many beekeeping supply vendors sell special propolis traps that encourage a particularly large harvest of the goo. Propolis can be rendered at home into various products, including medicinal tinctures, and even a top quality wood varnish.

Propolis has remarkable antimicrobial qualities that guard against bacteria and fungi. Its use by bees makes the hive one of the most hygienic domiciles found in nature. This property hasn't gone unnoticed over the centuries. The Chinese have used it in medicine for thousands of years. Even Hippocrates touted the value of propolis for healing wounds.

- **Royal jelly:** Royal jelly is a creamy substance made of digested pollen and honey or nectar mixed with a chemical secreted from a gland in a nurse bee's head. It transforms an ordinary worker bee into a queen bee and extends her life span from six weeks to five years!

  In health food stores, royal jelly commands premium prices rivaling imported caviar. Products containing royal jelly are sold as dietary supplements that boast all kinds of benefits, including weight control, energy stimulant, skin health, and even improved reproductive health and fertility. Royal jelly contains an abundance of nutrients, including essential minerals, B-complex vitamins, proteins, amino acids, collagen, and essential fatty acids, just to name a few. Using an eyedropper or an itty-bitty spoon designed for this purpose, you can harvest royal jelly from the queen cells in your hives (that's the primary place the bees deposit it) and sell it for a pretty penny.

  Any of the hives in this book (except for the four-frame observation hive in Chapter 7) would provide you with this opportunity. The larger the hive, the larger the harvest. But note that a large number of colonies are required to harvest anything beyond a minimal amount of royal jelly.

Although the health benefits of ingesting honey, pollen, propolis, and royal jelly have been touted for centuries, keep in mind that there's a relatively small percentage of the population that can have a severe and dangerous allergic reaction to ingesting the products of the honeybee. If you don't know your own situation, play it safe and consult your doctor or allergist before adding these products to your diet.

The main players in a beehive

In nature, honeybees typically build their hives in the hollow of a tree or some other cave-like environment. They like to be off the ground, safe from predators, and well protected from harsh weather. The hives in this book emulate, to varying degrees, the conditions bees prefer in nature while providing you (the beekeeper) with features that allow for easy inspections and manipulations to encourage strong and healthy colonies.

So what actually goes on inside a beehive? The following sections note the three main types of bees in a hive and what they do.

Her majesty, the queen

The *queen bee* is the heart and soul of the colony. She's the reason for nearly everything the rest of the colony does, and without her, the colony wouldn't survive. Only one queen lives in a given hive. A good-quality queen results in a strong and productive hive.

The queen's purpose is to lay eggs — lots of them. She is, in fact, an egg-laying machine, capable of producing more than 1,500 eggs a day at 30-second intervals. As a beekeeper, one of your primary objectives when inspecting your colonies is to confirm that each colony has a queen and that she's doing a good job of laying eggs and raising healthy brood. That's why many of the hives in this book include design features that make such inspections easy for the beekeeper.

Industrious worker bees

During the active season, more than 90 percent of the colony's population consists of *worker bees.* Like the queen, worker bees are female, but these girls are unable to mate and lack fully developed ovaries.

The term "busy as a bee" is well earned. Worker bees do a lot of work. They do it tirelessly, day in and day out. From the moment a worker bee is hatched, she has many and varied tasks clearly cut out for her. As she ages, she performs more complex and demanding tasks. Although these various duties usually follow a set pattern and timeline, they sometimes overlap. Worker bees may feed and care for the brood (nurse bees), feed and care for the queen (royal attendants), build comb, clean and do general housekeeping, guard the hive, and, of course, forage for pollen and nectar.

The more worker bees you have, the better it is for the colony, the more effective the colony's pollination services, and the greater the honey production. A number of the hive designs in this book allow for virtually unlimited growth of the colony. The Warré hive, the British National hive, and the Langstroth hive (see Chapters 8, 9, and 10 respectively) all include a modular design to provide such expansion.

Woeful drones

Drones are the only male bees in a colony, and they make up a small percentage of the hive's total population (less than 10 percent at the height of the season).

Procreation is the drone's primary purpose in life. Despite their high maintenance (the worker bees must feed and care for them), drones are tolerated and allowed to remain in the hive because they may be needed to mate with a new virgin queen (when the old queen dies or needs to be superseded).

When the weather gets cooler and the mating season comes to a close, the worker bees don't tolerate having drones around. After all, those fellows have big appetites and would consume a tremendous amount of food during the perilous winter months. So at the end of the nectar-producing season, the worker bees systematically expel the drones from the hive. They are literally tossed out the door.

Any of the hives in this book allow you to witness the banishment of drones. This is your signal that the beekeeping season is over for the year. Time to get back in the workshop and build some hives and equipment as holiday gifts!

Appreciating the Benefits of Building a Beehive Rather than Buying One

Many beekeeping supply companies are out there; a web search turns up dozens of them. Although you can certainly purchase a ready-made kit that will result in a wonderful home for your bees, building hives from scratch makes sense for all kinds of reasons. The following sections list some of the motivations that may prompt you to do it yourself, wind up with a potentially better product, and have more fun while you're at it.

Have fun and feel self-satisfaction

Building your own hives can be a wonderful new hobby that you can feel proud of. Knowing that the hives and equipment you use were made by your own hands is very satisfying. And the woodworking itself is enjoyable, from the intoxicating scent of the fresh-cut wood to the pleasure that comes with any do-it-yourself project.

I have another DIY hobby — I tap the sugar maple trees on my property and boil the sap down into delicious maple syrup. It's a hugely time-consuming project. My wife keeps reminding me that I could purchase maple syrup in the store for a fraction of the cost and for far less work. That may be true, but the fulfillment I feel from doing this myself far outstrips my wife's practicality.

In a way, the same is true with building beehives. Sure, you can buy a kit, and that may be cheaper than building your own. But making a hive from scratch is just plain fun and worth the effort. Plus, I'm convinced that the hives I build myself are better in every way than a store-bought hive.

Enhance your commitment to beekeeping, and better understand your bees' home

Building and better understanding beehives and equipment provide you with a greater awareness of what's most important to your honeybees and why. Rather than just reading about hives in a book, you can witness firsthand how the various features of different hive designs impact the productivity of your colonies and your ability to be a more effective beekeeper.

Modify designs to better meet your needs

The designs in this book are tried and true, but they're not necessarily the bee-all and end-all of hive designs. By all means, experiment and try some tweaks and modifications to what I suggest. You may come up with something that makes your life easier as a beekeeper or results in an improved all-around design for your bees. If you think you've stumbled upon a real breakthrough improvement, I'd love to hear about it — and so would others, I dare say. Be sure to drop me a line at `howland@buildingbeehives.com`.

Enjoy better quality than store-bought kits

Don't get me wrong, a lot of commercial beehive kits are very nice. But when you build hives yourself, you can add that certain *je ne sais quoi* that sets your hives apart from store-bought — that extra effort to achieve better fitting parts, slight tweaks in design to better suit your needs, or the use of nicer lumber and fasteners than come with mail-order kits. You know the old saying, *If you want it done right, do it yourself*.

Go green and recycle

If you have access to scrap wood, you're in an enviable position. The materials costs for building any of the hives or equipment in this book will be next to nothing. And besides the financial savings, you'll be doing the right thing by joining the admirable ranks of sustainability, recycling, and saving the environment. Congratulations!

If using scrap wood, be certain that it's free of any chemicals. You don't want to introduce any toxins to your bees.

Make building a family affair

Like beekeeping itself, building hives and equipment can be a fun family project. Now I don't suggest turning over table saw duties to your 10-year-old, but kids will have ample opportunities to help sand, paint, assemble, and accessorize your new hives and equipment. Or, perhaps like Tom Sawyer, you may slyly persuade others of the great privilege associated with doing those tasks you'd rather not do yourself.

Sell your handiwork

Building beehives is a business opportunity. Some of the hives in this book (such as the Kenya top bar hive in Chapter 5 and the Warré hive in Chapter 8) are gaining popularity among backyard beekeepers, but these hives aren't usually available from many of the major equipment suppliers. Beekeepers in your neighborhood may swarm to someone who builds quality hives and accessories. Put your newly found talents to good use and start up a side-line business for yourself. Your local bee club is a great place to start marketing your goods. And don't forget, a handmade hive makes a stunning gift for that special beekeeper in your life.

Making Plans for Your Own Beehive

This book has six beehive designs to choose from, as well as seven accessory designs. Perhaps you'll build them all, or perhaps you'd like a little help deciding which are the best for your situation. Chapter 2 provides some helpful guidelines for selecting the plans that best meet your needs (and match your skills).

Before you start building stuff, it's helpful to have a better understanding of where to locate your hives, how to deal with neighbors, and what you need to know about local laws and ordinances regarding beekeeping. I include these and other considerations in Chapter 2. I also cover the bees' basic needs regarding shelter and safety, and I explain the function and purpose of each of the basic components of today's most widely used hive, the Langstroth hive.

Setting Up Your Workshop

You need a place to build your hives and equipment. It may be a basement, a garage, or a corner of your apartment, or perhaps you're lucky enough to already have a dedicated workshop space for woodworking projects. In any event, the power tools, supplies, and inventory take up a fair amount of space and create quite a mess (lots and lots of sawdust). If you can, latch on to a location with at least 150 to 250 square feet of space. That should be ample for safely working on the projects in this book. It's a bit less than the size of a single bay in a garage.

Here are some basic requirements to consider:

- **Let there be light:** If you wind up in a basement or garage, the lighting may be rather underwhelming. In this case, get some shop lights (long, fluorescent or LED bulbs in a simple fixture) to supplement what's there now. The more light on these projects the better. You'll be working with some potentially dangerous pieces of equipment (power drills and saws), and you certainly want to be able to clearly see what you're doing. Brighter is better.
- **The buzz on electrical needs:** A number of the tools you'll be using are electrical, so your workspace needs ample outlets. The good news is that most consumer-grade tools run on normal household current. But some of these tools (like table saws) draw a lot of power (amperage), so be sure your workshop outlets have enough amps to run the equipment you intend to use. Otherwise, you'll be busy as a bee running back and forth to the circuit breaker.

- **Keeping it safe:** Working with power equipment and sharp, wood-cutting tools is inherently dangerous. You can do some real damage to yourself if you don't take safety precautions. Chapter 3 gives you the lowdown on creating a safe environment in which to build your hives and equipment.

Assembling Tools and Materials

If this were a book on building a house or making custom cabinetry, the list of tools would be very, very long. But hey, you're only building beehives and some related equipment. These plans are mostly variations on building a box, so I've intentionally kept the list of required tools and fasteners to an absolute minimum. I'll bet you already have some of these tools in a drawer somewhere (hammer, screwdriver, and tape measure). Chapter 3 gives you the skinny on the basic tools you'll use for the projects in this book.

The list of stuff you need for building beehives doesn't end with tools, though; you need actual building materials, too. In this book, I try to recommend materials that are most cost-effective and readily available. Pine is always a great bet — readily available, easy to work with, and cost-effective. But you need not limit yourself to the ordinary. Have fun and experiment using different woods, fasteners, and hardware that go beyond the mundane. Chapter 3 has ideas for various building materials and hardware, and Chapter 19 gives you ten ideas for adding beaucoup bling to your hives.

Getting a Handle on Carpentry Skills

I devote Chapter 4 to the skills you need before you jump into your beehive-making adventure. They include the following:

- Understanding *bee space* (the crawl space needed by a bee to pass easily between two structures)
- Measuring and marking materials
- Cutting lumber
- Building different kinds of joints
- Working with tin and wire
- Assembling a hive with a square, nails, screws, and glue

Having a handle on carpentry skills makes life a lot easier for the bees (by providing them with ideal living conditions) and makes the construction of the hive and accessories much easier for you.

Constructing Hives and Accessories

Beehives come in many styles, but obviously, in writing this book, I was limited to what I could fit between the covers. So with a little help from my backyard beekeeping colleagues, I identified the hives that would likely be the most popular with the widest range of hobbyists. The book has detailed materials lists, cut sheets, and assembly instructions and drawings for building the following hives (the ones listed first are the easiest to build):

- **Kenya top bar hive** (Chapter 5): One of the oldest beehive designs, this simple-to-build and cost-effective hive is gaining new popularity among backyard beekeepers. You won't find these for sale from any of the major beekeeping supply stores.
- **Five-frame nuc hive** (Chapter 6): Every backyard beekeeper can benefit from having a nuc on hand. They're handy for housing a captured swarm, serving as a nursery for raising a queen, or providing a small, easy-to-manage colony of pollinating bees in your garden.
- **Four-frame observation hive** (Chapter 7): This observation hive is big enough to support a small colony throughout the season yet small enough to serve as a portable teaching tool. It also provides a safe, up-close view of bee behavior, giving you a visual barometer of what's likely happening in your full-size hives.
- **Warré hive** (Chapter 8): This efficient design uses top bars (rather than frames and foundation) and has been gaining renewed popularity among beekeepers seeking more natural approaches to beekeeping. The design provides a living arrangement that's similar to how bees live in the wild. You won't find these for sale from any of the major beekeeping supply stores.
- **British National hive** (Chapter 9): This attractive hive is very popular in the United Kingdom, and I include it here for that reason. It's a little smaller than the Langstroth hive, and therefore slightly lighter in weight.

- **Langstroth hive** (Chapter 10): Without any doubt, the Langstroth hive is the most popular and widely used hive today. Certainly this is the case in the United States and in most developed countries around the world. You can't go wrong with this design. It's great for pollination, great for honey production, and easy to inspect. I've included designs for both eight- and ten-frame models of this hive.

The book also includes designs for popular and practical accessories and add-ons for your beehives. They, too, are listed from easiest to build to hardest. Accessories include the following:

- **Frame jig** (Chapter 11): This is a nifty gadget that greatly simplifies and speeds the task of assembling Langstroth-style frames and foundation.
- **Double screened inner cover** (Chapter 12): For the ultimate in hive ventilation, you'll love this double screened inner cover. It's used in place of a conventional inner cover and features an access that you can open or close depending on the orientation of the inner cover. I've included plans for eight- and ten-frame Langstroth hives, as well as the five-frame nuc hive and the British National hive.
- **Elevated hive stand** (Chapter 13): Getting hives up and off the wet ground improves circulation and helps prevent your hives from rotting out. This particular design can accommodate the nuc, British National, or Langstroth hive.
- **IPM screened bottom board** (Chapter 14): A screened bottom board has become a standard part of Integrated Pest Management (IPM). It's used to improve ventilation and to help monitor and manage varroa mite infestations. This design fits a ten-frame Langstroth hive, but you can adjust its dimensions to fit other hives in the book.
- **Hive-top feeder** (Chapter 15): Most beekeepers need to feed their bees at one time or another. Here's a great way to provide syrup to the colony without having to smoke and disturb the bees. I include feeder plans for both the eight- and ten-frame versions of the Langstroth hive.
- **Solar wax melter** (Chapter 16): Beeswax commands a higher price per pound than honey. You can harvest and render it for selling or making cosmetics and candles. This design uses the free power of the sun as its energy source.
- **Langstroth-style frames** (Chapter 17): Frames are certainly one of the more challenging accessories you can choose to build. Though most readers will be content buying frames for their Langstroth hives, for the adventuresome and more experienced woodworkers, this chapter provides detailed plans and how-to illustrations. I include plans for deep, medium, and shallow frames. Have fun!

Don't limit yourself to the prescriptions in this book. Everything I recommend is intended to keep the process of building beehives as simple and cost-effective as possible, but feel free to stray from my suggestions to build something truly unique and wonderful. It's totally up to you. Chapter 19 includes ten ideas for improving upon and jazzing up your hives and equipment. Get creative with

accessories, try different add-ons and finishes, or use a more aesthetic joinery technique. All this won't make much difference to the bees, but it will surely be satisfying to you and provide immeasurable bragging rights.

Having worked hard on building this stuff, you'll certainly want your handiwork to last as long as possible. So in Chapter 18 I provide ten tips for ensuring that your hives and equipment will last many, many seasons.