



The Essential Urban Farmer

By Novella Carpenter, Willow Rosenthal

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The "how-to" guide for a new generation of farmers from the author of *Farm City* and a leading urban garden educator.

In this indispensable guide, *Farm City* author Novella Carpenter and Willow Rosenthal share their experience as successful urban farmers and provide practical blueprints—complete with rich visual material—for novice and experienced growers looking to bring the principles of ethical food to the city streets. *The Essential Urban Farmer* guides readers from day one to market day, advising on how to find the perfect site, design a landscape, and cultivate crops. For anyone who has ever grown herbs on windowsills, or tomatoes on fire escapes, this is an invaluable volume with the potential to change our menus, our health, and our cities forever.

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Editorial Review

Review

"Organic farming in the city is so unexpected-yet it is the surest way to rebuild the vital connection between our food and how it is grown. This lucidly written, encyclopedic volume-which contains everything from homemade fertilizer recipes to chicken coop blueprints-is the single most useful resource I know for all urban dwellers."

-Alice Waters

About the Author

Novella Carpenter grew up in rural Idaho and Washington State. She went to University of Washington in Seattle where she majored in Biology and English. She later studied under Michael Pollan at Berkeley's Graduate School of Journalism for two years. She's had many odd jobs including: assassin bug handler, book editor, media projectionist, hamster oocyte collector, and most recently, journalist. Her writing has appeared in Salon.com, Saveur.com, sfgate.com (the *SF Chronicle's* website), and *Mother Jones*. She has been cultivating her farm in the city for over ten years now, and her neighbors still think she's crazy. It all started with a few chickens, then some bees, until she had a full-blown farm near downtown Oakland, where she lives today.

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PENGUIN BOOKS

THE ESSENTIAL URBAN FARMER

NOVELLA CARPENTER is the author of the bestselling *Farm City: The Education of an Urban Farmer*. She lives and farms in Oakland with her partner Billy, one cat, three ducks, five rabbits, two goats, and fifty thousand honeybees.

WILLOW ROSENTHAL is the founder of City Slicker Farms in Oakland, California, and teaches adults and children about urban gardening and consults with various groups to implement urban farming strategies. She lives in North Berkeley with her husband where they tend a very small veggie garden of their own.

ALSO BY NOVELLA CARPENTER

Farm City: The Education of an Urban Farmer

Please note that illustrations throughout are not necessarily to scale.

INTRODUCTION

Willow and I first bonded over urban farming. We were both growing vegetables, beekeeping, and raising chickens and ducks in the middle of the city of Oakland, California. When we met, at the turn of the century, I had recently started GhostTown Farm, one-tenth of an acre farm on squatted land near downtown. Willow had founded City Slicker Farms a few years before, as a nonprofit urban farming organization devoted to making affordable, urban-grown organic produce available to low-income residents in West Oakland. This is the book that we wished we had when we first started out, a how-to manual that speaks directly to farmers

trying to grow food and raise animals in the city.

We became passionate about urban farming for a variety of reasons. One is the way urban agriculture connects urban people to the food they are eating. The lettuce someone seeds, waters, and then harvests for dinner makes the freshest, most delicious salad they have ever had. Backyard chicken eggs are a revelation, partially because they are so fresh and partially because you raised the hen who laid this special gift. We realized that many city folks don't think they can produce their own food, and so they miss out on these connections. By growing even a little food in the city, these experiences become accessible.

Speaking of accessibility, urban farming is a way for people of all income levels to eat fresh, local, organic food. I knew that I didn't have enough money to buy organic produce or meat, and so I decided to raise it myself. An average urban backyard (25 feet by 40 feet), if cultivated intensively, has the potential to grow all of the fruits and vegetables for one person. Growing edibles in the city—even on a deck or small backyard—makes economic sense for people who have more time than money. Due to low incomes and lack of access to grocery stores, urban people fail to get the healthy nutrition they need. A few packets of seeds costing less than twenty dollars can produce enough vegetables for a year's worth of eating. If government regulations were changed and financial support given, many of the fruits and vegetables consumed in a city could be grown within the city itself, through a combination of backyard gardening, community gardening, school gardens, commercial gardens, and increasing urban agriculture on currently unused municipal land. This would mean everyone would have access to healthy organic food!

I say organic because this is the farming method that we encourage everyone to use. Organic means that you don't use chemically synthesized fertilizers or pesticides—two things that your neighbors in the city do not need to be exposed to. Other aspects of organic farming that we encourage, and explain in this book, are: building soil fertility through crop rotation; proper application of compost and green manures; and controlling weeds and pests by mulching, picking by hand, or using natural sprays or mixtures.

Rural organic farms do not necessarily follow practices that are sustainable for the earth, animals, or human beings. Growing in the city also means that you can go a bit beyond organic by growing a variety of crops on one site (instead of growing a single crop [monoculture]), using water efficiently, integrating livestock, and using city wastes to create a more closed-loop nutrient system. This avoids the use of factory-made fertilizers, using fossil fuels for operating farm machinery, or shipping produce and inputs—and, unlike commercial farms, ensures fair and safe labor practices.

Another method of urban farming is intensive farming, which enables growers to achieve high food yields in small spaces. Crops are spaced as tightly as possible and soil fertility is continuously built to support their growth. To achieve the highest yields possible while also maintaining the overall health of the plants and animals, we focus on the soil; because of this, the crops will thrive.

We have taken principles from intensive farming (sometimes called French intensive), biodynamic farming, permaculture, and edible landscaping, rolled them up in a ball and called it urban farming. As you begin to build your urban farm, you'll no doubt encounter other useful methods and ideas. There is no perfect way: raising food is a constantly changing dialogue between you the farmer and the landscape, animals, community members, and political and social circumstances.

There is no better time to start urban farms. We're entering a golden era, as farms spring up on rooftops in Brooklyn and Chicago; in abandoned lots in Detroit and San Francisco; in community gardens and in backyards. The thing is, none of this is new! The historical record shows that up until only recently, growing food in cities all over the world was the norm rather than an oddball fad. Think back to ancient Mesopotamia or the Incan empire, both highly urban societies; the people relied on urban and periurban farms for their

food. Learn about the French market gardens built during the Paris Commune. Read up on Detroit mayor Hazen Pinagree, who developed a system of farms in Detroit in the 1890s. Remember the victory gardens grown on the grounds of the White House, in New York's Bryant Park, on the grounds of businesses and people's backyards during both world wars.

It wasn't until the 1950s, when the highway systems were built and the era of cheap fossil fuel began, that the strict division between rural and urban began to take shape. In the 1970s, during the oil crisis, an ecological movement started to grow that encouraged self-sufficiency in cities. Books on sustainable living, such as *The Integral Urban House*, demonstrated that one could grow vegetables and raise honeybees and chickens in the city.

There is a strong element of social justice in this latest wave of interest in growing food in the city. There is often vacant land in so-called blighted areas—empty lots that could be used by the people who live there to produce food. This is why Willow founded City Slicker Farms. With neighborhood support, she started a few gardens on empty lots and set up a farm stand to sell the produce at affordable prices; no one was turned away for lack of funds. Neighbor interest in self-sufficient food production led to the addition a few years later of a backyard garden program for low-income residents. Today City Slicker Farms has built two hundred backyard gardens that produce tens of thousands of pounds of food per year in West Oakland. Urban farming is empowering: It can create self-sufficiency in communities who need it most.

A move toward more food production in the city is a way to combat other threats to humanity: climate change, the irresponsible use of fossil fuels, and a ballooning urban waste stream. Small urban farms don't have to use fossil fuel-derived fertilizers or pesticides. Urban-grown produce doesn't need to be shipped in refrigerated trucks or by airplane. We can rechannel the wastes away from landfills and toward productive uses, such as fertilizer. Restaurant food scraps can feed urban chickens and rabbits; busy cabinetry shops can supply shavings for garden paths; coffee grounds from the local café can be used to make great compost. By recycling wastes we reintroduce city people to that great American ideal of thrift.

At the time Willow and I started talking about this book I had just helped launch a store in Berkeley that sells organic locally made animal feeds, farm equipment, and books and tools for self-sufficient living, and that also provides classes about urban chickens, goats, and rabbits. The classes often sold out in a few days, so I knew there was a great hunger to learn these skills. We noticed that there was no definitive how-to manual for setting up, maintaining, and expanding an urban farm and began talking about collecting all the how-to knowledge we'd gathered over the previous ten years into a manual. Our goal then was to write that book, to create a one-stop resource for both beginning and seasoned urban farmers. Our years-long efforts to distill our field experience has resulted in *The Essential Urban Farmer*, the book you hold in your hands.

SUSTAINABILITY BULL'S-EYE: FARM INPUTS AND OUTPUTS

When sourcing materials keep in mind that local is more sustainable.

The Essential Urban Farmer is divided into three parts and reflects our philosophy: First observe; then take action; then sustain the results; and finally, expand your efforts. The first part, Designing Your Urban Farm, can be read as a beginner's guide to advance planning. It covers choosing a site, testing the soil, and creating a layout that uses the space you have to grow the most food possible. Though many people want to just dive right in, it's often best to first take a step back, assess what you have, and build a strategy. We encourage baby urban farmers to start with small steps, like growing some lettuce or carrots. Then move on to bees or chickens. You'll build on your knowledge base and stay sane by moving slowly.

Part II, Raising City Vegetables and Fruits, involves getting your hands dirty in order to grow vegetables and fruits. You'll read about how to build soil fertility, set up growing beds, start seedlings, plant seeds and

plants, and irrigate your crops. If you live in an apartment or have a small amount of growing space, go to page 113. After you've planted, you'll need to learn how to defend your garden (organically, of course) from pests and disease. And then, finally, you'll find out about best practices for harvesting your homegrown bounty.

If you've already tried your hand at growing vegetables, or have chickens but are looking to expand your farm animal repertoire, Part III, *Raising City Animals*, is for you. This section covers six animals that will thrive on your city farm: honeybees, chickens, ducks, turkeys, rabbits, and dairy goats. There are in-depth directions for setting up housing, feeding, and maintaining your menagerie. We've also included tips for saving money on your small-scale animal operation by using the city's waste for food, bedding, and building materials. Finally, we also include step-by-step instructions for processing animals for the dinner table.

At the back you will find an elaborate resource section that lists materials and tools, places from which to order farm equipment and livestock, listings of urban farms all across the country, tables of information for seed savers, and sample seeding and planting calendars. Since we are based in California, we consulted and visited seasoned practitioners throughout the country to learn about their climate zones. Their best practices are touched on throughout. We are indebted to them, and welcome input from you, our readers, and fellow urban farmers.

Whether you're just getting into urban agriculture or at it for a while, we're sure you'll find something of use here, even if it's primarily a sense of solidarity. So please send ideas and other resources to essentialurbanfarmer@gmail.com.

Finally, though we often shy away from the R word, we daily see more evidence that urban farming is becoming a real revolution. The most important things that Willow and I have learned haven't been about chickens or vegetables, rabbits or fruit trees; it has to do with the people in our communities. We've seen firsthand the way animals and plants bring our neighbors together. Cultivating life allows people to feel a connection to the earth, and to each other. We encourage you to not just sit with this book but to go out and seek experienced mentors, to gather and share knowledge and resources. We all eat, and the two of us think that if we all grow a little bit of what we eat, the world would be a better place.

—NOVELLA CARPENTER

PART I

DESIGNING YOUR URBAN FARM

Whether you have an urban farm or are just starting out, this section is an invaluable primer. Although it may be tempting to just start and ask questions later, this section will give you a deeper understanding of what you are doing and how it fits into a variety of different farming philosophies. It will also help you ensure that you're growing food that is safe to eat—a huge consideration for the urban agriculturist.

The biggest hurdle is finding land that is appropriate for farming. The soil must be tested for heavy metals. Local ordinances and neighbors should be consulted. If you have a landlord, he must be convinced that it is a good idea. Before beginning the fun stuff—planning where to place your veggie beds and animal housing, collecting tools and materials for building—you must secure a safe location.

CHAPTER 1

CHOOSING YOUR URBAN FARM SITE

First off, where will you be farming? Selecting a site for many of you will be easy. It'll be built on the yard, deck, or roof of the house you own. If this is the case and you already have land access, skip to chapter 2, to get started. For the rest, who are looking for land—apartment dwellers, ambitious backyard gardeners ready to expand, renters, or owners whose land isn't suitable—we offer ways to secure some. If you're a renter with the perfect farming situation, first get permission from your landlord.

HOW TO SWEET-TALK YOUR LANDLORD AND BE A RESPONSIBLE STEWARD

In the interest of getting your rental deposit back, and of using the space you live in responsibly, it's important for renters to get clear, written permission from their landlord for planned changes to the landscape. It is especially important with deck and rooftop gardens to discuss what you want to do and to explain how your methods will protect built structures. It works best to try to think like an owner when approaching your landlord. It's likely their main concerns will be: increased liability exposure; property value reduction; higher water bills; messes; and neighbor complaints.

When getting permission, address these concerns up front in a written, proactive proposal. Let your landlord know if you want community members to be involved. Ask if their property liability insurance would cover such participation or if they would need you to take out an additional policy. List everything you want to do, make a map, and show that you have discussed the proposal with any neighbors who might be affected and that you have a plan, if they want, for how to return the property to its original state when you eventually move. If the water bill isn't in your name, let your landlord know you will handle increased water bills, for instance, by offering to pay an extra amount or transferring the bill into your name. If you approach the subject this way, your landlord might just see that you are responsible and agree to your plan. Be open to their suggestions and concerns, and be willing to compromise, and you'll likely come to an agreement.

Being a renter might also affect the type of farm you design. You may want to keep your trees in movable containers, and skip building wood boxes for your veggie beds, so you don't lose your investment when you move.

FINDING VACANT LAND

In most cities there are hundreds or thousands of acres of unused land that could be producing food: empty lots; utility company right of ways; neglected backyards; median strips; parks. Vast sunny lawns at institutions such as churches, universities, hospitals, prisons, and senior homes eat up water that could be used to grow produce. Once your eyes are trained to see such possibilities it can be hard to turn off the habit of fantasizing beautiful veggie gardens growing in these spaces or imagining a herd of goats grazing. The first step in turning the fantasy into a reality is finding out who owns or controls the land and contacting them. Vacant land generally falls into three categories:

privately owned by individuals, companies, or religious groups;

owned by the city, county, or state; for example, county tax assessor offices or park districts;

owned by a public authority or district; for example, transportation authority; utility district.

If you spot a vacant lot with potential, first write down the street addresses on either side of the site and the cross streets of the block. Then check with your county tax assessor's office. You will find maps showing each block and street address in your city either online or at their office. Its parcel number will be listed on the map. Carefully check to see if your site comprises more than one lot, or if it's the yard of a nearby house

or business.

With the parcel number in hand you can look up the ownership history, which will be listed in a separate online section or written source material filed at the office. The most recent owner will be listed along with their mailing address. Knowing the historic use of the property will tell you its previous use; for example, if you simply see a list of individual names, most likely it was a residence or vacant lot for a long time. But names such as Acme Chemical Company or Billy's Junk Yard may indicate problems you don't want to touch with a ten-foot dig bar.

BASIC SITE CONSIDERATIONS

So, you're out cruising around looking at various places to farm: maybe one is an abandoned lot; maybe one is the backyard of a friend; maybe one is a piece of land owned by a church. For a baseline, research the following:

Who owns or controls the land?

Is there access to water? If you have to install municipal water service or a well it could cost you thousands of dollars.

Is there vehicle or cart access for moving in materials?

Is there good sunlight for most of the day? If not, do you have permission to trim or remove trees, bushes, or vines?

Is the site protected from extreme wind?

Does the slope of the land make terracing essential?

Is the site prone to flooding or standing water?

Is there garden-ready soil over most of the site, or is it covered with blacktop, concrete, or gravel?

Could the soil be contaminated with toxins? (See chapter 2.)

Can you use the land long enough to merit the significant time and energy you'd have to put in?

Survey the land and locate the municipal water valve, a concrete lid somewhere in the sidewalk or road adjacent to the plot; if it's a friend's backyard, find the hose bib (the outdoor water source). Locate walk-in and drive-in access. Hang out to observe the sun and wind patterns. It's also important to get onto the site with a dig bar and check for gravel, concrete, and blacktop. Concrete removal can be prohibitively expensive, so consider a new site if the entire lot is paved. Before beginning negotiations, you will want to take soil samples and test for contamination. (See chapter 2.)

CONTACTING THE LANDOWNER AND CREATING AN AGREEMENT

Unfortunately, in most counties, the owner's phone number is not provided at the tax assessor's office. If it's a governmental agency, you can look it up easily, but those of private owners are more difficult to track: They may not live at the address provided in the records. Try calling information for their number. But often your only option is to send written correspondence. Sadly, you may find a *perfect* site that has sat unused for

years—and send off letters never to receive a reply.

Local realtors are also a good source of information on ownership and land history. They may know the contact information for an owner you can't otherwise find, and they often know the use history of land. Realtors can be very friendly to the idea of community beautification through gardening. Hey, greening raises property values and sales commissions!

Once you have made contact, the owner may turn out to be amenable, and even enthusiastic, about having their land used productively. Government-owned land is a different ball of wax. Government bureaucracy can result in a maddening circle: a long list of blasé government employees that ends back with the first buck passer. Being tenacious and having an unfailingly friendly, compassionate attitude can pay off for you in the end. Government agencies rarely have systems in place for dealing with such inquiries, which means that yours is unexpectedly adding to someone's workload. You may have to blaze the trail and help the agency create a system to allow private citizens to use government land for urban farming.

The following guidelines will improve your chances of a positive outcome when approaching either private or government owners:

First write a one-page letter that includes the following:

who you are;

a brief description of your proposal for the land, including any community benefit (e.g., community garden plots; donations of produce to food banks);

a proposal to lease the land for free or for a comfortable price;

your willingness to pay for water, obtain any necessary liability insurance, and leave the property as you found it, should you leave;

an offer to provide a more detailed proposal along with personal references;

your contact information;

your gratitude for their consideration.

If they respond, write a letter or e-mail proposing a meeting. Include a proposal that describes the following:

your ideas for the land, including a layout diagram and any community benefit;

the minimum amount of time you are willing to use the land; for example, that you would like to use the property for at least three years, with a provision for renewing your agreement on a year-to-year basis (any less time, e.g., three months, isn't worth your while);

any structures you want to put up, and any existing plants or structures you'd like to remove to facilitate your plan;

how you will maintain the property, in terms of safety and aesthetics (owners can be cited by the city for

blight and will be concerned about this);

what you will do if and when you leave the land (e.g., cleanup; restoring; finding a qualified successor);

who will have access to the property;

who will work the land;

options for how the water bill would be paid (e.g., either by transferring it to your name or by arranging to pay the owner);

your willingness to obtain liability insurance, including a possible provider and/or organization name and contact information;

your intention to obtain the necessary business licenses and agricultural inspections;

character and/or professional references.

Note: If you want to incorporate animals, like chickens or bees, it might be best to keep it to yourself at this point. After a year of smooth sailing with growing produce, broach the delicate subject of livestock with the land owner.

If the owner agrees to your using the property:

Negotiate an agreement in writing.

Ideally meet in person to hammer out the details.

Create a written document for signing. It's not necessary to involve a lawyer, but you may want to have it reviewed by one.

If you can't meet the owner's demands, it would be better to find another site than to commit to something that's uncomfortable.

Set up the payment system for the utilities:

There should be easy ways to communicate about and pay the water bill. The ideal solution is to transfer the water service into your name, since busy landlords can be tardy in passing them along.

If the bill isn't transferred into your name have the landlord send you quarterly copies with your portion noted.

Set up liability insurance:

Find out if the owner has a liability policy, and if so, if it will cover your activities. If not, offer to pay for increased coverage, or take out another policy.

Find out if your city has a program to provide it for community gardens, or if there are nonprofit urban farming organizations willing to add your site to their policy. Because rates are calculated based on the total number of acres, if your garden is small enough, adding you may not increase their rates.

Consider purchasing a personal umbrella insurance policy as well, since few insurance policies will cover everything someone could sue for.

If the owner is a governmental agency:

Contact your city parks and recreation department to find out if they have a community garden program. If so, ask if they help residents start new ones and what support they offer.

Contact the following organizations to find out if they know anything about efforts to facilitate the use of government land for urban farming in your area:

- The Community Food Security Coalition;
- The American Community Gardening Association;
- Local nonprofit urban farming and community gardening organizations;
- Commercial urban farming operations;

Note: Joining forces under the umbrella of an already existing nonprofit organization can streamline the process and lend credibility to your project.

Contact your local city council member and enlist their help in gaining approval for your project. In addition, city council members often have discretionary funds they can devote to pet projects.

Recruit a list of supporters by pounding the pavement. You will want to reach out to local residents, business associations, community groups, and churches to ask them to sign a letter and/or attend city council meetings in support.

PURCHASING VACANT LAND

Creating productive and beautiful urban farms on loaned land can eat up thousands of dollars and wo/man hours, only to be lost once someone decides to “develop” it. If you own the land though, you don’t have to worry about losing it, and it will be truly sustainable. Purchasing land for urban farming can make sense or not, depending on your real estate market.

If you’ve decided to purchase vacant land, consider your proximity to the site. You will be spending a lot of time there, and if you have to commute your energy may flag. The best scenario is next door, or within a few blocks of your residence. As the owner, you will be responsible for any necessary cleanup of garbage or toxic waste, so be especially careful in your assessment. Purchasing a former auto mechanic’s used parts yard, or the former site of an industrial building, is dicey unless you have the funds for a major cleanup project. Sites covered with blacktop or concrete will require a huge amount of time and money to rehabilitate.

In addition to the purchase price, as noted previously, you will need to buy liability insurance and pay yearly property taxes. Loans for purchasing vacant land are structured differently than those for purchasing

residences. Banks often won't make loans for it, and if they do, the interest rate will be higher. Private loans can be obtained, again at higher rates than home loans. The best scenario is obviously to save up your money, find a site that's cheap, and purchase it outright. In rare cases agricultural or open space preservation land trusts may be able to help finance or protect your land from future development. Having your land designated as protected open or agricultural space by such an entity can also reduce your property tax liability.

Another way to purchase land is through county property tax default auctions. Counties auction properties when the owner has failed to pay their annual property tax for more than five to ten years, depending on the county. Success stories using this strategy abound: empty lots in the high-end Bay Area real estate market purchased for under ten thousand dollars; entire lots in Detroit purchased for a few hundred dollars. Focusing your search on less desirable neighborhoods helps, but this isn't a rule of thumb. Know that auctions aren't always logical: It just depends on who shows up or logs in (many are conducted online now) to bid on the day. It's important to know that full payment must be made upon your successful bid. Private auctions often operate on a similar basis.

CHAPTER 2

URBAN SOIL, WATER, AND AIR CONTAMINATION

After you've figured out where you're going to farm, the next step is to test for toxins in the soil. It's a downside to growing in the city but don't be bummed by this reality: Since farming encourages testing and cleanup of toxic soil, we think that the possibility of contamination in urban areas should be cause *for* not against it. You have an incentive to find out if you are currently unknowingly being exposed to toxins. If you are, farming or gardening can reduce it by containing and covering the soil and by the cleaning actions of plants and soil organisms.

For example, the main pathway for lead poisoning, especially in children, is ingesting contaminated dirt. When a garden is planted and mulched with compost, wood chips, etc., the dirt is less exposed and is contained by roots. Adding compost dilutes the soil, lowering contamination levels. Compost also binds to heavy metals, making them less bioavailable to plants and people. This is perhaps the most effective method for remediating soil containing lead. (For more information, see "Lead in Urban-grown Vegetables," Cornell University Cooperative Extension.) As a defense, plants often concentrate more of the heavy metals they absorb in their roots, which are not usually the edible portion of your produce. Also, the amount in the fruits and vegetables grown in these environments is much lower than that in the soil itself, so the chance of being poisoned by eating produce is usually quite low.

WHAT CONTAMINANTS TO TEST FOR

At the bare minimum, everyone should test their soil for heavy metals, no matter what. It's relatively cheap, and it will give you peace of mind. If you need further prodding, take the survey below. If you answer yes to any of the following questions, you will definitely need to test your soil for heavy metals.

Is it possible your land is the former site of a factory or business that might have used chemicals, motor oil, etc.?

Was your house built before the use of leaded paints was discontinued in 1940?

If so, was its upkeep neglected at any time and the paint allowed to peel onto the ground?

Was the paint scraped or sandblasted without proper containment?

Was your house built prior to 1945? (That's when the burning and burying of garbage was finally prohibited in most cities. Though this practice probably continued into the seventies in many low-income communities.)

Did a historic house or structure burn down on the property?

Is the property near a freeway, busy road, or airport? (Tire dust contains toxic heavy metals, and prior to 1975 leaded fuel was used; also, jet fuel still contains lead.)

Heavy Metals

The most likely way to be poisoned by heavy metals is by actually eating or breathing in the dirt itself, not from eating produce grown in soils containing them. Still, it's good to know if heavy metals are present in dangerously high quantities and take appropriate precautions.

The reason they are so harmful to humans is that the body mistakes them for essential nutrients and stores them in tissue. Lead is the most common heavy metal contaminant in urban soils and the primary cause of heavy metal poisoning in children. Most of what is in garden soils was left from the days of leaded plumbing, paint, and fuel. It binds to cells in the body and is absorbed readily instead of calcium and iron. Health problems from lead exposure range from kidney, nervous system, and thyroid damage, especially in pregnant women, to the stunting of brain development in children.

Though urban industry can result in quite a cocktail of heavy metal elements, the most common elemental contaminants after lead are arsenic, mercury, and cadmium. Arsenic is released into the environment through metal smelting and galvanizing, by power plants, and by the manufacture of chemicals and pesticides; it is also common in paint, rat poison, fungicides, and wood preservatives. It is a primary ingredient in pressure-treated lumber commonly used in outdoor structures. Look for the telltale greenish tint to the wood. Like lead, arsenic is likely to remain in soil unless removed. Former orchards are common sites of high arsenic levels, and since many cities sprawled into surrounding farmland, you may be living on the site of what used to be an orchard.

We are also unfortunately surrounded by unsafe mercury levels. Mining operations and various industrial processes release mercury, toxifying urban soils. Most concerning of all, mercury was also added to paint as a fungicide until 1990.

Cadmium is a by-product of mining, smelting, and metal plating, and is used in batteries, Polyvinyl chloride (PVC) plastics, and paint pigments. It can be found in soils because insecticides, fungicides, sludge, motor oil, and commercial fertilizers using it are still on the market. Cigarettes also contain cadmium, so the old practice of burying trash can be a source of elevated levels.

We hope you're scared now—really, really scared. Since testing for heavy metals is cheap, and the results of exposure can be extremely serious, unless you are certain there is no risk you should just go ahead and test the soil. Luckily, soil-testing labs will test for both the dangerous and the useful nutrients and soil texture all in one fell swoop. Depending on the lab you choose, the hazardous elements tested for can include arsenic, cadmium, chromium, copper, lead, manganese, mercury, molybdenum, nickel, selenium, and/or zinc. We recommend using a lab associated with a university, as their tests are reliable and prices are usually low. Make sure to specify which elements you want included in the test in addition to lead.

Acceptable levels of heavy metals in soil

There are currently no national standards for safe amounts of heavy metals in agricultural soils. In 1996, the U.S. Environmental Protection Agency (EPA) set soil screening levels (SSL) to be used as an evaluation tool for cleaning up contaminated residential properties and Superfund sites.

ENVIRONMENTAL PROTECTION AGENCY SOIL SCREENING LEVELS FOR HEAVY METALS IN SOIL

Heavy Metal Testing Procedure

Here's how to prepare your soil samples before having them tested by a lab. See Appendix 1 for a resources list of soil-testing facilities.

Draw a diagram of your land and break it up into 5 to 20 quadrants, depending on your budget, by drawing horizontal and vertical lines at regular intervals. Be sure to note where any structures are and where north is. You will take a mixed soil sample from each quadrant.

Number your quadrants on your diagram.

Make sure you plan to take samples from at least two areas that you find suitable sun for growing. That way, if one is contaminated and the other is clean, you can go ahead with the second area.

Get plastic or paper bags—two for each quadrant—and label them with the quadrant sample number. You will send one bag to the lab and keep one in case of loss, or if you want to do other types of testing later.

Bring a shovel, trowel, bucket, permanent marker, and the bags outside. Your tools must be stainless steel, since galvanized or aluminum tools can influence the test results.

Starting with quadrant number one on your map, dig approximately four holes randomly scattered within the quadrant. The holes should be between 12 inches and 18 inches deep. Put the soil you dug out to the side of each hole.

Shave off some soil from one side of each hole, making sure to get some from its entire depth, and put it in your mixing bucket. Stir the soil samples in the bucket. From this mixture, put about one cup in each of the two bags.

Fill in the holes well to prevent tripping, replacing any remaining soil from the mixing bucket as you go.

Clean out your mixing bucket.

Repeat for the remainder of the quadrants.

Send one set of samples to a lab; make sure to note that they are to test for heavy metals.

Guidelines for Farming and Gardening in Heavy Metal–Contaminated Soils

After you receive your test results you can create a garden plan. Along with them you will receive information on whether the levels are low, medium, or high. Below we offer a number of options to guide your decision making.

Low-level Farming Options

Use lime to change the pH balance of the soil if necessary (a pH balance of 6.5 reduces lead availability to plants).

Farm directly into the existing soil.

It's fine to allow critters such as chickens, ducks, turkeys, goats, and rabbits to eat scraps and weeds from the garden.

Medium-level Farming Options

Farm in constructed planter boxes (12-inch boxes will reduce the lead levels; 24-inch boxes, or boxes lined with a root-impermeable barrier, will virtually eliminate exposure).

Dilute the soil by adding compost—and high-quality compost is important. Since the legal level for lead in commercially produced compost is 300 parts per million, it's best to use some from a site that provides heavy metal test results for their materials.

Lime the soil if necessary (a pH balance of 6.5 reduces lead availability to plants).

Make sure paths and beds are mulched to create a barrier to human exposure to dirt.

Wear gloves and wash hands after gardening.

Plant fruiting crops (they don't concentrate lead in the edible portion of the plant).

If you grow root vegetables, peel them before eating.

If you plan to keep animals on this land, mulch the soil with at least 6 inches of wood chips. Chickens will dig into the ground and may inadvertently ingest lead, which studies show will be passed on into its eggs. Rabbits, ducks, turkeys, and goats should not be allowed to eat leafy greens and weeds grown directly in the contaminated soil, as their meat and milk will bioaccumulate the lead. Keeping honeybees will be fine, especially since they can forage as far as 2 miles away.

If you grow leafy greens, soak them in a 1 percent vinegar solution for at least ten minutes, and then wash well to clean off surface dirt.

Keep the lead where it is by mulching paths in the medium lead section with the plant refuse from that section rather than adding it to compost piles that could be used in other areas.

A more drastic option is to remove 12 inches to 18 inches of soil and take it to a landfill; replace it with imported topsoil and/or compost. But be aware that your local landfill may not accept contaminated soil. In addition, this just gives the problem to people who live near it, so you have to think about where you stand on that.

HEAVY METAL SOIL REMEDIATION TECHNIQUES

An effective strategy for transforming lead into a harmless form is to add colloidal phosphate, usually derived from the mined remains of ancient marine animals or fish bone meal, to your soil. It will create lead

phosphate, which is immobile in the soil and not absorbable by plants, as well as provide a balanced source of phosphorus and calcium for your plants. Follow the recommendations provided with the colloidal phosphate or bonemeal to know how much to add to your soil. Retest your soil six months later, and add the recommended amount again if necessary.

As of the writing of this book, this method is being tested in Oakland and New Orleans. See appendix 1 for more information and resources.

A word of caution about remediation, i.e., cleaning heavy metals from the soil: Many tout the ability of special plants to absorb and remove heavy metals from soils. Unfortunately, to remove significant levels of lead from your land you would need to grow successive crops of these plants for many years, sending the plant material to a toxic-waste dump. This strategy, called phytoremediation, uses hyperaccumulator plants—such as sunflowers, various *Brassic*as, geraniums, amaranth, and nettles. While researchers have found plants that concentrate amazingly high levels of some metals, unfortunately lead, the most common heavy metal in ur-ban soils, is not among them. A chemical called EDTA (ethylene-diaminetetraacetic acid) can be added to the soil to concentrate hyperaccumulator plant uptake of lead, but the soil must then be remediated (cleaned) of the EDTA, an expensive undertaking.

High-level Farming Options

Observe medium guidelines and/or:

Take produce samples, dry them, send them to the lab for testing, and act according to the danger posed by the levels found in the results.

Grow only ornamentals.

Don't raise animals except bees, which can forage up to 2 miles away.

Cap the entire area with root-impermeable material and use raised boxes and pathway mulch like wood chips, straw, rocks, etc., that cover the contaminated soil.

Cap the entire area with root-impermeable material and use the space for other activities, such as for a greenhouse, animal housing on top of the capped soil, or a community gathering space.

Remove 12 inches to 18 inches of soil to the landfill and replace with imported topsoil and/or compost. (See questions about disposal of contaminated landfill under Medium-level Farming Options.)

In the end, if you get a high heavy-metal test result, it's up to you to decide whether you want to be ultrasafe (and pave over your yard) or whether you feel okay with growing crops using careful safety guidelines. If you decide to farm, you can send dried plant tissues to the lab to test for heavy metals. These results will tell you if the plants are absorbing them, making them unsafe to eat.

CHEMICAL CONTAMINATION

Unlike the handful of heavy metal contaminants, the list of possible chemical contaminants in urban soils is vast. Health problems from exposure to chemical contaminants are much more varied than those from heavy metals, but typically they include cancer, liver, and nerve damage. You don't want the stuff in you or your food! Because testing for organic compounds (chemicals) can be extremely expensive compared to heavy

metals, we encourage you to do some sleuthing instead.

Is My Site at Risk for Chemical Contamination?

Answers to the following questions can help you discover if your garden is at risk for chemical contamination:

- Is your land the former site of a business that used toxic chemicals?
- Are or were there any nearby factories that may have released chemicals into the ground or the water table?

You will need to make the rounds of a number of helpful offices to find out the answer to the first one. The zoning designation of your neighborhood will tell you if businesses are now or were allowed there in the past. The city planning and zoning departments will most likely have a map that shows the designations of your neighborhood. They will also have a record of any building permits. For example, if someone applied to build an auto shop, it will be noted in the records. Most cities also have historic preservation departments. The staff at these offices can be very helpful, often having encyclopedic knowledge that extends to many individual properties. They will most likely be able to help you find out the history through various records, including Sanborn maps that show historical land uses. These also often can be found at your local university.

If you find out that a business operated on your land, especially industries such as auto shops, manufacturing plants, dry cleaners, metal smelters, or chemical or galvanizing plants, don't grow food unless you have the funds to test for a wide range of contaminants (a test for one can cost hundreds of dollars) and intend to embark on a major cleanup project. If you are in this situation, contact the United States Environmental Protection Agency for more information.

WATER CONTAMINATION

It would be a good idea to find out about your water table, specifically how high it is. If it is permeable to groundwater runoff and high enough for plant roots to reach it (about ten to fifteen feet below the soil surface), your plants could absorb toxins in this water. While many chemicals are broken down into harmless substances as water soaks through the soil, some can remain in a toxic state in groundwater. Contact your local water district office to find out about the water table in your area. They will have maps showing the aquifers and how close they are to the surface.

If the water table is high, ask around in your neighborhood, especially among longtime residents, to find out if there used to be major industrial or factory activity that could have caused groundwater contamination. Contact the U.S. Environmental Protection Agency to find out if there are any problems with groundwater toxicity in your area. Of special concern are sites near current or former chemical-manufacturing companies. Many of them used unsafe storage practices or simply dumped chemicals on the ground.

If your water is supplied by a regional or city water company, data on heavy metal and other types of water contamination are published quarterly or annually. Often your water company will send this to you automatically, but if not, give them a call. Some outside research on heavy metal levels in municipal drinking water will show you that *no* level of lead is acceptable (this is equally true for food). The U.S. EPA's "action level," i.e., the level at which they take action against a water company, is 15 parts per billion.

Another source of heavy metals in water are plumbing systems within homes. Unfortunately, this does not apply only to old plumbing—new solder also contains lead. Brass, copper, and lead pipes, fittings, and solder

containing lead can result in higher water concentrations of lead. Hot water tends to release the lead from such pipes, so using only cold water in the garden is a good practice. Flushing your faucet into a drain for five to thirty seconds releases water that may have been sitting in your pipes, carrying any lead residues away. If you suspect high levels, have your water tested by a lab.

AIR CONTAMINATION

Although urban particulate air contamination causes a lot of health problems in people, it isn't as much of a concern for garden-grown food. Airborne heavy metals and particulates fall onto the soil, especially near industrial plants and freeways, but aren't likely to be absorbed into plants through their leaves. As long as you wash your produce, this contamination shouldn't pose much of a risk. An exception is if your site is very close to a freeway. Freeway driving produces very toxic tire dust that falls within about a hundred yards and can contaminate your soil, resulting in airborne residue on leaves and concentrations of heavy metals in the soil that can be absorbed by your crops.

IS IGNORANCE REALLY BLISS?

This chapter may seem very discouraging, but knowledge is the best protection against the health dangers of living with toxins. The fact is, we are all living in a toxic soup caused by the industrial society we live in, and the more we know about it, the less we will tolerate such production of goods at the cost of our health. If we begin to take responsibility for making our personal environments safe—and one of the ways to do this is through gardening—the collective result will be a safer environment for everyone.

CHAPTER 3

CREATING YOUR FARM SITE LAYOUT

You have a blank slate. Now it's time to create your urban farm. Before breaking ground, you will want to create your garden in your imagination. This will enable you to see how everything will fit together, how the work will flow, and what plants and animals will be the most pleasing to you. Make diagrams. Draw pictures. Make a collage. Move things around. Play. Use your imagination before making the financial investment. The following pages will help you know enough about urban farming to make a preliminary layout plan, but remember: These topics will be covered in-depth in subsequent chapters.

GETTING TO KNOW YOUR SITE

The first step in designing your urban farm is to evaluate the qualities of your site and the best use of each area. Because this is an *urban* and not a rural farm, you'll want to take the realities of the environment into account in your thinking.

Before you start planting and building, you should get to know your land really well. Spend some time on your land observing the sun and wind patterns. Be aware that in North America, if you are observing from late fall through early spring, the sun pattern will be more northerly than it will be in the summer. Sketch the rough dimensions of your land on a piece of paper. Note down the following:

existing buildings, fences, entry gates, and sidewalks;

water spigots;

existing perennial plants (trees, shrubs, etc.);

partial and full shade areas;

windy areas, and the prevailing wind direction;

south-facing walls (these areas will be warmer);

slopes and notable land contours;

the compass directions. If you don't have an innate sense of this, you're going to have to find a compass!

If you plan on keeping animals, note the approximate distance of your neighbors' houses from your fence line.

Often every square foot of ground on urban farms needs to be hand dug to sift out crabgrass, garbage, and concrete. You will need to take stock and be informed about what you're getting into. Knowing about major cleanup needs up front can be inspiring, but finding out about them halfway into the project can be discouraging.

Walk the entire area with a shovel and a dig bar (an eight foot steel bar with a pointed end). Evaluate your soil by noting any areas of gravel, concrete, stones, or garbage that may need to be removed. Every foot or so investigate whether there are buried concrete slabs, old foundations, or other junk below the soil surface by digging holes or poking the dig bar into the ground. If you hit something hard, excavate the edges to see how big it is. Old concrete walkways or low walls can be broken up fairly easily with a sledgehammer and pried out with a crowbar (be careful not to break water and sewer lines). But if you find a large continuous slab you will need to decide whether to remove it or build your garden on top of it. The cost of removing large areas of gravel, blacktop, or concrete can be prohibitively expensive. A cheaper option is to build taller boxed beds over the slab. For more information on what to do if your site is covered with a concrete slab or blacktop, refer to chapter 6.

Next is an evaluation of the weed situation. Note the types and extent of the weeds. If you discover that you have what are called pernicious weeds, you will need to incorporate major weed removal into your plan. Pernicious weeds spread by underground roots. If even one piece of the root is left in the soil, in most cases it will resprout into a new plant. Simply trying to yank them out of the ground isn't very effective on these weeds, and using a tiller just multiplies their growth, so prep yourself for a very labor-intensive weed removal process. Chapter 13 describes how to best tackle the problem.

You may also want to make a plan to remove existing perennial trees and shrubs that create too much shade, acidify your soil (in the case of conifers), or are just plain unattractive. If you have permission, don't be afraid to cut down and remove ornamental shrubs and trees in order to plant fruiting trees or other crops. Unwanted ornamental plants can also be dug up and offered for free on the Internet.

Your site investigation will let you know how much up-front cleanup work you're in for. If you have found any conditions that need to be dealt with, such as buried garbage, concrete, brickwork, blacktop, pernicious weeds, or perennials to be removed, make a list and allot time for the cleanup stage.

CREATING A FARM SITE DRAWING

Now comes the fun part. It's time to make a plan. One of the most enjoyable tasks for a farmer is daydreaming with seed catalogs and gardening books. This is the time to note down specific types of fruiting shrubs and trees you want. It's the time to decide where to locate annual and perennial plantings and what

materials you will use to build structures. Of course there is a dynamic between theory and practice. You should think of your design as a set of guidelines that will change as you experiment and find out what works best for your site conditions and your life.

Draw a scale map on a piece of grid paper or poster board. To measure your site, lay a tape measure out on the ground and walk naturally for twenty feet, counting your paces. You can then calculate each pace's feet and inches. Pace your land. Write down the measurements. Decide on a scale that will fit your paper; for example 1/4 inch = 1 foot.

One of the best ways to plan your farm layout is to cut out pieces of paper scaled to your diagram and the size of the beds, compost bins, etc., and move them around. Consider the work flow: It can be pretty annoying to have to walk clear around your house to the side yard each time you want a trowel or rake, or to have to move manure into your garden by bucket because your compost piles aren't accessible by wheelbarrow. You will find sample layouts on the next few pages. If your "land" is a deck, a patio, or a rooftop, see a layout here.

IDEAL FRONT YARD FARM (22' X 50')

IDEAL BACKYARD FARM (40' X 50')

IDEAL EMPTY LOT FARM (50' X 125')

You may want to skip ahead to parts II and III at this point to learn more about the various crop and farm animal options so you can decide what to include. Below are some of the practical elements you also might want:

Urban Farm Components

crop-planting beds (either inground or boxed)

children's garden beds

garden beds with access for the handicapped

vertical growing structures (trellises, grow tubes, grow bags, etc.)

fruit trees

fruiting shrubs and vines

seedling propagation area

hoop house or cold frames (see here for description) for cold weather growing

composting area (compost bins, worm composting containers, manure aging bins, brush pile, leaf pile)

bulk materials storage (mulch, compost, straw, sawdust)

animal housing and yards

beehives

animal supplies storage

ornamental plantings

vehicle access

tool storage

produce washing and packing setup

shaded group seating/work/outdoor eating and hanging out areas

benches

outdoor cooking area

rainwater catchment

grey-water system for diverting used household water to the garden

water storage cistern

CLIMATE AND ORIENTATION

In most geographical locations the most ideal garden site would be sunny all day, slightly sloped, facing south or southwest, and wind free. In practice it is unlikely that this is what you'll get. The good news is that there are ways to improve less than ideal situations. You can plant food-producing shrubs and trees to shield your farm from wind. Shady areas can be used for animal housing, toolsheds, compost bins, and work or gathering space. If your site is facing east or north you can use season-extending cold frames, tunnels, or hoop houses to heat up your site.

Your climate will also influence your garden layout. If you live in a coastal or northern city, you will need to take advantage of warm spots. Locate seedbeds, planting beds, hoop houses, and cold frames in sunny spots and near heat-storing, south-facing walls. If you live in the South, reverse this to protect summer-grown crops with shade.

DIMENSIONS AND ORIENTATIONS OF URBAN FARM COMPONENTS

In our years of urban farming we have learned that certain dimensions and orientations of farm components work best in the city.

Rectangular Beds

While they may not be very creative aesthetically, rectangular beds truly are space and time saving. Whether inground, boxed, or edged with some other material, your beds should be no wider than four feet if surrounded by paths. If they are any wider it is too difficult to reach the center without stepping into the bed. To learn how to build garden beds please refer to chapter 6.

Two feet is a good width for beds accessible from only one side. Make your beds as long as you can, but no more than about thirty feet. Beds are best oriented from north to south, allowing for the same light exposure in all parts. However, if the land slope or some other factor makes this difficult, you can run them east to

west or at an angle.

Keyhole Beds

Keyhole beds are formed in the shape of a horseshoe. They have more surface area and less path space, making them space efficient. It's hard to build them as boxed beds, since the sides are curved, but you can easily edge them with bender board or various found materials, such as logs, hunks of concrete, or bricks to define the space. The width of its ring(s) should be three and a half feet wide, with inner paths that are one to two feet wide. Using keyhole beds is a great way to achieve a more naturalistic, curvy appearance without sacrificing efficient use of space.

Boxes

Boxed beds can be from four to twenty-four inches high. Eighteen to twenty-one inches is an ideal upper limit ergonomically, unless wheelchair access is required, in which case they need to be thirty inches high to allow a wheelchair to fit underneath the top board.

KEYHOLE BEDS

Paths

A great way to design your paths and beds in a rectangular plot is as follows. Make two paths, each between three and five feet wide, with one centered down the length and the other down the width of the space. They will cross in the center. Create a two-foot-wide planting border around the periphery of the site with another three-to-five-foot-wide path alongside it. These will be your major paths—they are wide enough to accommodate carts and provide disabled access should you need it.

Paths between the beds throughout the rest of the site should be between one and two-and-a-half feet wide—not wider—to maximize growing space. Irregularly shaped beds and paths eat up space that could be used for growing, and just make more weeding work.

If wheelchair access is required, paths must be three feet wide, and there must be periodic five-foot-diameter wheelchair turnaround spaces. A good compromise is to create a wheelchair-access section of the farm.

Fruit and Nut Trees

In order to avoid shading annual crops with your fruit and nut trees, train them to be no more than seven feet high. To save space, train trees to be flat along fences or to grow as a hedge along major paths—or site them where you need wind protection, or on the north side of your farm site. Plant taller fruiting or ornamental trees over animal yards or seating areas to create shade.

Fruiting and Ornamental Shrubs and Vines

Locate shrubs along the property line of your urban farm in areas that need wind protection or in beds where they won't shade other crops. Most shrubs can be pruned and trained to the desired height and width within reason.

Vertical Growing Structures

Trellises—essentially any form of flat growing frame—can be planned along fences and down the length of growing beds. Vertical trellises are preferable to tomato and cucumber cages. If your bed is three and a half feet wide, run the trellis slightly off center, one and a half feet from one side. This will allow for more

efficient use of space, and will create a shadier side that is narrower, with more of the shade falling on the adjacent path. This narrow, shadier strip can be used to grow salad greens, radishes, and cool-season *Brassicas* in the summer.

OFFSET TRELLIS PLAN VIEW

Grow tubes, grow bags, and living walls can be used to increase growing square footage and are ideal for shallow-rooting crops, such as onions and celery. Grow tubes can be built suspended above growing beds or patios. The layout will be about one and a half to two feet wide, and can be as long as you like. The height of the top tier of tubes shouldn't be higher than you can reach, about five feet. Vertically oriented grow bags can be suspended above beds or patios or hung from existing walls and railings. Living walls are shallow receptacles that are suspended from the sides of buildings. Each line of bags or living walls should be afforded about two feet of width and be of an accessible height. See here for illustrations.

Animal Housing and Yards

Local planning and zoning codes are important for the layout of animal structures, since many cities require a certain distance from your and/or your neighbors' house or other buildings. Passersby can pose a risk to your animals through taunting and rock throwing. Ideally, locate animal housing deep within the center of the property or closer to the safety of your house. Provide ample shade. Make sure food and bedding can be stored close by. In many world cultures household meat, milk, and egg animals are located underneath the house or deck. This option naturally provides shade and shelter for your animals and keeps them close for easy caretaking.

Animals need a space that is protected from the elements (indoors) as well as a yard to run around in (outdoors). Allow the following amount of indoor and outdoor space:

Beehives should also be hidden from possible molestation, and should be out of *your* way as much as possible, with the entrance pointed away from heavily trafficked areas. Bees leave and return to their hives all day long, in pursuit of pollen and nectar—you don't want to be caught in the middle of a bee highway. Allow a two-by-three-foot space for each hive.

Tool Storage

Use space for tool storage that is less than ideal for gardening. Depending on your climate, it may not be necessary to shield tools from the weather on all sides as long as you keep your seeds inside the house. Use the spaces under staircases or decks for tool storage by building a sloped roof of corrugated material suspended from the floor beams above and a Peg-Board wall organizer attached to the post beams holding up the stairs. Peg-Board is one of the top ten most wonderful inventions of all time—use it to hang and organize tools.

Compost Bins, Worm Bins, Bulk Materials Storage Bins, and Animal Supply Bins

To properly decompose organic matter, such as kitchen scraps, weeds, garden trimmings, and animal manure, compost piles must heat up. Compost bins or piles must be at least three feet cubed to achieve this. Each one needs a few feet of access space in front and a three-square-foot space next to it for turning the pile. Be sure your water source can reach your bins, since proper moisture levels (like that of a wrung-out sponge) is a key condition for composting. In areas with a lot of rain or snow, a roof over your compost area is ideal because a compost pile can get too boggy for proper breakdown.

Small, plastic, manufactured worm bins can be kept close to or inside the house. If you have a large volume

of food scraps, you may want to construct larger ones, however. If left outside, worm bins should be shaded and protected from wind, rain, and snow. They also can be built either of wood, cinder block, or poured concrete. Three and a half to four feet wide and two feet high are good dimensions; they can be as long as you like. See appendix 11 for sources of worm bin plans.

Warning: Don't put any decomposing material up against a wooden fence. You can imagine the result: a rotten fence! If you have a brick wall or metal fence along the perimeter, this would be an ideal back wall for compost, brush, and material storage bins. Also, if you're in an area prone to rat infestations, know that brush and compost piles will become habitats for rodents (see here for control methods).

In intensive urban farming we don't always let beds lie fallow under cover crop to regain soil nutrients; therefore, large amounts of homemade compost, free municipal or county compost, and locally obtainable animal manures should be applied to beds two to four times a year. These materials must be stored. Sawdust and straw for animal bedding also need a place to live. One of the most important design considerations on the urban farm can be where these materials are stored.

Try to avoid having to unload your materials from your truck into a wheelbarrow and then into a pile or bin; ideally, a driveway would allow you to back right up and shovel the compost right off. If you don't have vehicle access, put the bins or piles along a fence from which you have sidewalk access. You can back your truck up onto the sidewalk and shovel the materials over the fence.

If you plan to have materials delivered by a dump truck, the driveway needs to be eight feet wide. In this case, the storage bins should be six to eight feet wide (the widest dump truck bed will be eight feet), with an overhead space of about fourteen feet clear of tree limbs and power lines.

Propagation Area

You can propagate seedlings in- or outdoors; see chapter 9 for instructions. Indoor seedling propagation involves installing fluorescent lights over a table. You will need a protected space for much of the year to propagate outdoors, such as a greenhouse, a cold frame, or a homemade greenhouse box. Make sure there is a water supply nearby, and find a spot that gets sun, won't shade your annual growing beds, and has good drainage. Building a greenhouse off of a house or garage can save you the effort of constructing the fourth wall. It's best to site seedbeds, greenhouses, and greenhouse boxes near the house or entry to the garden, so that you will be more likely to water and monitor them.

After seedlings are transplanted from open trays to pots, they will need a place to be "hardened off." One or more tables should be set up in the shade or under a shade cloth (a synthetic material that can block varied percentages of sunlight) near the greenhouse. It's great to have another table of a comfortable work height there for the tasks of seeding and transplanting. If you plan to purchase seeding mix in bulk, also include a three-sided storage bin, ideally with a roof, in your plan.

Hoop Houses and Cold Frames for Cold-weather Growing

If you live in an area with hard freezes or long winters, you may want to extend the harvest with greenhouses, hoop houses, or cold frames (see here for an explanation of these structures). Locate such structures in sheltered but sunny locations. If you have differences in elevation on your land, be sure not to site them in cool hollows.

Produce-washing and -packing Setup

Whether it's a homemade plywood-topped table with a hole cut in it for a mixing bowl washtub, a cabinet

with a fully plumbed sink, or an old bathtub and table, a place to clean, bunch, and package your produce is indispensable.

The produce-washing and -packing area should be set up in the shade with access to running water. Added bonus: Pipe the wash water from the outdoor sink to growing beds or trees, thus recycling the water.

Group Seating, Working, and Outdoor-dining Area

From the simple—a seating circle of straw bales—to the grand—a gas-fired barbecue on a tiled patio—a place to rest and enjoy the fruits of your labor is essential. Favorites include picnic tables, fire pits, wood-fired cob ovens, brick patios, low-slung decks, and small lawns. Shade provided by trees, arbors, or umbrellas is a must. It's especially pleasant to locate this area in the center of your garden for good views of all the bountiful beauty.

Children's Garden Beds

With your help, children will love to plant, observe, explore, and taste. Building a few small, low box beds and surrounding them with a low white-picket fence and gate will let children know that it is their own special place. Having this space will also help you if your children are getting into *your* beds and digging half the soil out into the path. You can gently guide them to their space and work with them there, where you don't have any expectations aside from their own exploration. Children love hidden nooks and special things all their own. Creating bean or pea tepees where they can hide and wild patches they can tunnel through are great ways to build on their innate love of nature.

Rainwater Catchment and Grey Water Reclamation Systems

Collecting rainwater and household wastewater can cut down on your water bills and conserve a precious resource. Rain barrels and storage racks should be sited close to the gutter downspouts that fill them.

Grey-water systems require constructed wetlands or other methods of cleaning kitchen and laundry wastewater for use in the garden. Allow for a five feet by fifteen feet strip of land near the sewer pipe you will be tapping into for grey-water processing and storage. See chapter 11 for more information on constructing rainwater and grey-water systems.

LAYING OUT YOUR FARM PLAN

After you've evaluated your site, decided what elements to include, and drawn up a site plan, it's time to see how it works in the actual space by laying out your plan with stakes and string. The first preparation you must do is cut down or weed-whack any brush that will get in the way (be sure to wear goggles!). Depending on the size of your farm, you will need to collect, or make, around a hundred two-foot-long stakes. Next, gather together twine, a measuring tape, a hammer, some scissors, and your plan and head outside.

Using your diagram and the measuring tape, begin staking out the various elements you plan to include. Lining things up accurately can be difficult, so try to start with something that seems straight and relatively square, such as a fence or house. Pound stakes securely into the ground at intervals around the perimeter of beds or structures, and then delineate the edges with string. Tie it to one stake and wind it around the rest until you return to your first stake. Stake and label the locations of perennial trees and shrubs.

After staking out your plan, sit with it for a few days or weeks. Observe it from various angles. Walk around and pretend you're gardening. Imagine bees zooming in and out of the beehive: Is it out of the way of human traffic? Pretend you have to muck out the rabbit cages: Are they situated close by a compost area? Ask for

opinions. Follow your intuition.

If you are working with a larger site, you may want to break up the work into phases, so it doesn't seem too daunting—physically and monetarily. Don't become overwhelmed. With a consistent effort, even as little as a few hours of work per week, your dream farm *will* become a reality.

CHAPTER 4

CHOOSING FARM-BUILDING MATERIALS, TOOLS, AND SUPPLIES

Now that you have created a plan for your urban farm, you will need to decide which materials to use for your infrastructure (compost bins, chicken coops, hoop house), acquire the proper tools (shovels, aphid spray nozzles, and manure forks), and load up on supplies (beekeeping gear, seeds, and straw) before you can start growing. This chapter will share the information you need to salvage or purchase them.

We're in favor of reusing discarded materials from the voluminous urban-waste stream—it's a great way to reduce your ecological footprint and save money. To find free or affordably priced second-hand materials, some good places to start looking are salvage yards, second-hand stores, big trash pickup days, garbage transfer stations and landfills (sometimes employees won't allow you to take garbage from the dump), and garbage areas behind businesses. Other great resources are freecycle.com, craigslist.com, and state reuse programs that match larger companies and institutions with people who can use what they no longer need (see appendix 11).

When considering free or salvaged materials, look at them with an eye toward the amount of clean-up work that will be necessary to make the materials usable. Removing nails and screws can take significant time and effort. It may be more worth it to pay for wood at your local salvage yard that has already been cleaned than to use free wood full of nails. Seriously cracked, warped, or rotted materials are not worth your time, even if free.

To keep neighbor relations on the sweet side you'd best avoid turning your yard into a repository of possibly, someday useful materials. In cities you can find old windows, pallets, and any number of other free materials any day of the week. An indispensable rule of thumb is to only allow yourself to get materials when you are ready to use them. Of course, there's an occasional gold mine you won't want to pass up, but sticking to this rule will keep you and your neighbors in a land of beauty, not junk.

BUILDING MATERIAL NO-NO'S

Although plywood and pressboard can be used to build inner parts of structures, outdoors they degrade quickly. They should also be avoided for outdoor use due to the toxic nature of the glues used to bind them. A toxic situation will result if soil, plants, or animals come in contact with any of the following materials:

Pressure-treated wood. You can recognize such wood by its slightly green hue and/or "stapled" look where the insertion of chemicals makes tiny indented lines.

Plywood or other glued-together pressboards or laminates (if you can see layers on the end grain, it's glued).

Any material that may have been painted with leaded paint.

The following pages give suggestions for many good garden building materials.

WOOD AND FAKE WOOD

Douglas Fir, Cedar, or Redwood Lumber

If you want it built to last, most experts recommend redwood for all garden structures. However, redwood trees are endangered—it's a bit of a sin to buy new redwood. In addition, new-growth redwood is often much more porous than old-growth wood of any kind, so, practically, using new redwood doesn't make much sense.

While it is very expensive, salvaged redwood and cedar are obtainable. If your budget can handle it, go for it. Salvaged Douglas fir is much easier to find and is usually inexpensive. Salvaged Douglas fir is of two types: old-growth full-dimension lumber and second-growth common-dimension lumber. Old-growth full-dimension lumber will last a lot longer than newer wood and is larger and sturdier. To tell the difference, first look at the size of the boards. Full dimension is just that: for a 2 × 4, it's 2 inches by 4 inches. Common-dimension lumber starts out at the full dimension and is surfaced to be smaller. A 2 × 4 is actually 1 1/2 inches by 3 1/2 inches. Next look at the grain of the wood. The closer together the rings are, the older growth it is, and the longer it will last. (see here for a table of lumber dimensions.)

Old-growth redwood and cedar last the longest outdoors, followed by old-growth Douglas fir, new-growth redwood, and new-growth cedar. New-growth Douglas fir has the least staying power, but salvaged new-growth Douglas fir has the advantage over brand-new wood of having been fully cured and hardened inside of the building it used to be a part of, so it will last longer than new Douglas fir.

When you're at the salvage yard evaluate salvaged boards for rot and straightness. "Sight" your boards to see if they are warped. If you're not sure how to do this, just ask a staff member at the yard—they know all about it and will be happy to initiate you.

You can use logs to edge your beds

Branches and Logs

While they will eventually decompose, tree branches and logs, especially when cut to short lengths, are quite handy for creating low-edged beds. The wood can be oriented horizontally or vertically, depending on the length. To make a stable bed border it's helpful to dig a shallow trench for the bottom of the wood to sit in.

Pallets

It's easy to get both softwood and hardwood pallets for free, and they are great for making three-sided compost and material-storage bins, boxed beds, and container garden boxes. Hardwood pallets last much longer than softwood pallets. Try driving a nail into the wood. If it's really tough it's probably hardwood and will make a very long-lasting building material, but you'll need to predrill holes for the screws. The easiest way to build structures such as planter boxes, storage bins, or compost bins out of pallets is to pound rebar or metal T-stakes into the soil every two feet or so and thread the pallet over them perpendicular to the ground. You may want to line the inside with burlap, another fabric, or layers of cardboard to keep materials or soil from falling out. You can also deconstruct pallets to use the lumber.

Making a compost or storage bin out of pallets supported by rebar stakes

Milled Lumber from Tree Care and Removal Companies

Some tree-care companies mill the wood they salvage from downed urban trees. This is a great local

resource of lumber. Since these are local companies they might even be willing to donate lumber to your cause.

Fiber-cement Board

Fiber-cement siding comes in 4 inch by 8 inch sheets as well as various siding “board” styles. A mixture of fiberglass and cement, it certainly fits the bill for durability. Fiber-cement-board siding is an obvious choice for siding any garden structures you build, such as sheds, animal housing, etc. Its one failing as a boxed-bed building material is that it is a bit too flexible, but with a well-built structure on the inside (use plastic lumber for this), it works well and will never rot. While cement is a nonrenewable mined resource, unlike with ones made of wood, you’ll probably never have to rebuild your planter boxes.

Recycled Plastic Lumber and Landscape Edging

Recycling technology has improved by leaps and bounds of late. Scientists have worked hard to find just the right mixture of various types of plastic garbage to make building materials that are strong and durable. For a long time most plastic lumber was problematic as a planter-box building material due to its flexibility. When the beds were filled with soil, the boards would bulge. In addition, it is often composed of recycled materials *and* wood, defeating your goal of using 100 percent recycled materials.

A new type of plastic lumber, made of recycled milk jugs for strength combined with recycled bumpers for rigidity, has finally solved the problem. We left a phone message for Thomas Nosker of Rutgers University Advanced Materials via Immiscible Polymer Processing Center to get the skinny on whether we could build planter boxes out of the stuff. He called us back right away from the U.S. Army base in Fort Bragg, North Carolina, where he was working on the construction of a tank bridge. “Well, if it can support a tank, I think you can use it,” he said. He also added that the research showed clearly that nothing toxic leaches out of the material. This is great news for urban farmers. Due to all of its qualities, we judge recycled-milk-jug lumber to be the number-one choice building material for urban farmers who choose to buy new materials. (See appendix 11 for sources.)

Flexible plastic landscape-edging boards, 5/8-inch thick and of various widths and lengths, are great for, yes, edging, and also to create curved raised boxes or terraced beds. They’re really bendy, so they can be used to make curved shapes, but if you want a square bed, they’re a nightmare. You can also buy stakes of the same material for installation (put the stakes opposite where the pressure is coming from so the fasteners don’t pull out, i.e., the outside of the bed). Be sure to find a brand made of 100 percent recycled materials rather than of a mixture of plastic and wood.

Salvaged Solid Wood Doors

Antique solid wood doors, often made of redwood, are a great width for tall boxed beds. The only problem is that they’re almost always painted. You must remove the paint to ensure that it doesn’t peel into the dirt. To make a solid box, be sure to use 4 inch by 4 inch posts in the corners and fasten with bolts going through.

Sapling Wood

Thin green sapling wood can be woven on sapling wood posts that are at least 1 inch in diameter to make beautiful fences and trellises. It’s just like weaving a basket: over, under, over, under, around the posts. As the wood dries it becomes rigid. To find sapling wood, go to a creek or river and look for willow, dogwood, or other river trees. Or, in the city, ask a landscaping company to give you their sapling prunings.

Woven sapling wood fence

Peeler Core Timber Stakes and Bamboo Stakes

Trellises and deer fences can be constructed easily with either of these types of stakes. Peeler Core stakes are usually 4 inches in diameter and have a pointed end, so they can be pounded into the ground. They are often pressure-treated, so look for ones that aren't. Bamboo stakes are a bit trickier to get into the ground without splitting; the thicker the diameter at the bottom the better. To drive bamboo into the ground cut off one end at an angle and the other flat. Both of these types of stakes can be set in soil using a ladder, a baby sledgehammer, a fence-post level, and a tape measure to check for height. What's great is that you can save a lot of time and money (on hardware) by attaching the trellis crosspieces, plastic mesh, or wire mesh with outdoor-rated zip ties. Voilà, you're done.

Tree Bamboo (4 inches-plus Diameter)

Tree bamboo is used in many countries to construct multistory buildings. Because it has only recently gained popularity in the United States, it is scarce but obtainable. It can be used in container gardens to build horizontal trough planters, but it can be used to build structures as well. To build a planter, split the tree bamboo in half, cap the open ends, and drill drainage holes in the bottom. Set it on a patio or suspend it aboveground off fences or posts. Japanese tool companies sell bamboo-splitting tools.

A peeler core stake

This horizontal tube planter can be made of recycled PVC pipe or bamboo. It can be suspended from a fence or from posts.

METAL

Corrugated Roofing

Corrugated roofing, which is especially economical when purchased used, can be utilized with the corrugations running either way to make great boxed beds (see here for instructions and illustrations). It is also obviously very useful for roofs.

Hardware Cloth

What a misnomer! This is not cloth at all but woven wire-screen mesh with openings from 1/2 inch to 1/8 inch. A bit more durable than poultry netting, we often use it sunk into the ground underneath animal housing and fencing to keep critters out. If moles or gophers are a problem, line the bottom of your raised beds with hardware cloth or stucco-reinforcement mesh, both more durable than chicken wire.

Hardware cloth

Post Anchor Brackets/Post Bases

Post bases are metal brackets used for attaching wood fence posts to a poured concrete fence posthole. Part of the bracket extends into poured concrete and the other part extends upward to support the post. Wood eventually rots. If you've set your fence posts or planter-box supports in cement and they rot out, all you have is a large chunk of unusable cement in the ground. If you've set post bases in cement, however, all you have to do is replace the wooden post to repair the damage.

Poultry and Aviary Netting and Stucco Wire

Poultry and aviary netting, which are also misnomers, are actually made out of metal wire. Typical

hexagonal chicken wire, also called poultry netting, is actually useless in the chicken coop but can be used for other building jobs. Stucco reinforcing wire (exactly the same size but of thicker-gauge wire) is the material of choice to deter gophers, as it won't degrade underground as quickly as poultry netting. For animal housing, use aviary netting. With 3/8-inch openings (unlike poultry netting or stucco-reinforcing wire, which have 1-inch openings), you will avoid infestations of rodents and chicken feed-eating birds.

Varieties of poultry netting: chicken wire and aviary netting

Rebar

It's quite easy to find salvaged rebar, a multiuse building material, for the urban farm. It can be used to stake plants. Or pound 1 1/2-foot rebar stakes into the ground in the corners of beds to prevent the garden hose from dragging across your plantings as you run it around corners (poke a tennis ball on the top to protect your shins). Rebar can be bent to make a structure for an enclosed chicken run or greenhouse. It can be pounded into the ground to support hollow building materials, such as salvaged PVC pipe, to make a hoop house. Endless, endless uses. To cut it, use a special metal blade in your power saw of choice.

Hose guide to protect your plants

T-stakes

The t-stake, often used as a basic field-fence post, goes in easy and is hard to get out. Like wooden stakes, they are great supports for trellises and fences, though when pounding in, they're a bit harder to keep straight. They're cheap and can often be found used.

Welded-wire Cement Reinforcement Mesh (Also Called 6-6-6)

Cement reinforcement mesh is the one material we would want on a desert island. Well, as long as we had zip ties, too. Since it's marketed to the commercial construction trade, it's inexpensive compared to trellising materials sold to the home gardener, which are always more expensive. It can be bought in flat sheets or bulk rolls.

CONCRETE REINFORCEMENT MESH DETAIL

Concrete Reinforcement Mesh aka 6-6-6

This material has holes large enough to allow you to harvest crops and is rigid enough to support the weight of all trellised garden crops. Farmers never mess with those store-bought things called tomato cages, because 6-6-6 is perfect for making cylindrical cage supports for tomatoes, cucumbers, melons, and winter squash (see here for an illustration). You can also use a 6-6-6 cage to make a simple cloche (a glass or plastic case that fits over one plant): Wrap the cylinder in clear polyethylene sheeting or floating row cover (a specially formulated synthetic material) and pop it over a pepper or melon seedling. The cloche will keep the plant warmer in the spring, thus increasing the chance for a good harvest come summer.

Cement reinforcement mesh (6-6-6) can also be bent in an arch over planting beds to make a cucumber trellis, a polyethylene-covered hotbed, a floating row-covered low tunnel, or a shade-cloth frame. Be sure to leave the sharp 6-inch ends of the wire free on each side to anchor it to the ground. Thus, it is self-staking. It can be attached to rebar stakes for animal housing, for example, to form a structure for aviary netting. And last but not least, lined with shade cloth, burlap, or filter fabric and attached to posts, it can form the walls of compost bins, storage bins, and even planting beds. Because it's not galvanized or stainless steel, 6-6-6 will eventually take on a rusted look and will rust through only after many years.

Rigid Welded-wire Mesh Panels (Also Called Livestock Panels)

If you've got money to spend, and need to outdo Martha Stewart, livestock panels make durable and beautiful trellises and fences, especially if you order ones with a bright finish. Rigid panels can be ordered online from welded-wire manufacturers or stock-fencing companies or bought at retail operations in agricultural towns. Look for gauge sizes 6 (3/16 inch) through 3 (1/4 inch), a 60 to 96 inch height, and 4 to 6 inch square openings.

Cages

If you have animals you will need cages, both for housing and for transportation. Big cages are great for goats, small ones for chickens, and medium-size ones for rabbits. Mostly metal ones have better ventilation and don't fall apart like their plastic cousins. Collapsible metal dog crates are the best, as they can be stored flat and are incredibly strong and durable. They are available through craigslist.com, friends, and on curbsides across America.

6-6-6 low tunnel with polyethylene sheeting

FABRIC

Repurposed Denim and Burlap

To prolong the life of planter-box wood, staple burlap bags or old blue jeans on the inside. While the wood will still get wet, it will be shielded from the soil decomposition process that rots wood over time.

Floating Row Cover

Also known by the brand names Reemay or Agribon, floating row cover is a white woven fabric essential for protecting crops from cold temperatures and insects. It is often used as a temporary warmth-providing blanket to protect frost-sensitive crops during a cold snap or placed on newly transplanted seedlings to ward off pests that like to feast on young plants.

Deer Netting

Deer are a plague on farmers even in many urban areas. Mark our words: They will eat everything. It's easy to keep them out, though. For an "invisible" deer fence, simply set posts using 6 to 8 foot rebar stakes all around your garden. Attach deer netting to the fence with zip ties or unrottable string, leaving 6 inches of extra material at the bottom. Dig a shallow trench between the stakes. Using irrigation stakes, secure the deer netting at close intervals inside the trench and bury it. Make sure to install a gate so you can get it. If your gate lacks the proper height, attach grape stakes or some other lightweight wood reaching 6 to 8 feet high vertically above the gate.

Plastic Fence Netting

Plastic fence netting, most often seen in use in its orange form during highway construction projects, can be very easy to come by for free and is very useful on the farm. Think temporary poultry enclosure. Why construct a complicated wood and chicken wire "chicken tractor" when you can just enclose the bed you want your chickens to scratch up with this flexible but durable bright orange plastic fencing and a few bamboo stakes.

Woven Shade Cloth

If you're growing crops in an area with scorching heat, or want to grow cool-climate crops such as those for salad mix during the summer, shade cloth is a miracle product. It comes in varied shade-blocking percentages, starting at about 30 percent and going up in increments to 95 percent for almost-full shade. It can be bought by the roll or the foot. Attaching lengths of it over low tunnels will create a cool, shady area underneath. Or cover the greenhouse with shade cloth in the hot summer months. Though it is plastic (boo hoo!), woven shade cloth can last for over a decade.

BLOCKS, BRICKS, AND STONE

Urbanite

The first time someone used the word “urbanite” with us we thought it was some fancy material similar to terrazzo. We found out that it's just a euphemism for broken-up concrete chunks. Urbanite is the quintessential urban farm building material for obvious reasons. The cons for its use are the same as for stackable concrete blocks—it's bulky. The pros are that it's free, plentiful, doesn't rot, and isn't toxic. Standing the chunks on end instead of placing them flat-side down helps avoid wasting space; a shallow trench for the bottom third or so to sit in will be needed for this. The height of the bed will therefore be limited to the size of the chunks. If stacking horizontally, angle the wall in slightly to keep it from falling apart.

Edging a bed with horizontally oriented urbanite

Edging a bed with vertically oriented urbanite

Stackable Concrete Blocks

Stackable concrete blocks, or cinder blocks, abound in many forms and are a great urban farming building material. Because they are wide, however, the blocks take up a lot of room, which is a drawback to using them to build raised beds. They are expensive when new, so you'll want to look for used or free ones.

ALTERNATIVE MASONRY UNITS

Also known as AMUs, alternative masonry units are an environmentally friendly homemade alternative to cement masonry units (stackable concrete such as cinder blocks). They are made of soil mixed with sand and either straw, rice hulls, or coconut coir. You will need a compressed earth block press to make them, which can be purchased on the Web; it will be quite pricey, but for large-scale projects it could be worth the investment. See appendix 11 for resources.

Bricks

Many urban farm beds are edged with bricks, since they're plentiful at the salvage yard and dump. Clean them well with a chisel and hammer, so they fit snugly, and stack them carefully, so they don't fall out of place. Brick is also a wonderful patio material.

Stone

Whether mortared or dry stacked, stone can be a beautiful material to use for building planter boxes in situ. Traditionally, fieldstone dredged out of a farmer's soil was used to build walls and terraces.

GREENHOUSE AND COLD-FRAME GLAZING

Polyethylene Sheeting

Polyethylene plastic sheeting has many uses, from solarizing weedy ground to covering cold frames to covering homemade greenhouses, hoop houses, or garden-bed low tunnels. Plastic is gross, we know, but it's cheap and useful. To mitigate the environmental harm, order plastic intended for agricultural use; you'll be able to reuse it for a number of years. Fasten it securely to cold frames by sandwiching it between rigid materials, such as strips of wood.

Twin Wall Polycarbonate Sheets

These durable if expensive sheets have replaced glass as the farmer's choice for greenhouse glazing. The material lets in the right amount of light and heat but has the added benefit of insulating against cold. The reason? It is formed of two layers of plastic with air-filled channels in between. These somewhat flexible sheets can be attached to a variety of frame shapes to make cold frames, cloches, and greenhouses. Screw down with large-head screws to attach to wood. If attaching to metal, the rigidity allows for punched holes and zip-tie fastening.

Windows

Old windows make great greenhouse boxes, and your animals will probably appreciate the view if you put one in their housing.

OTHER BUILDING MATERIALS

Concrete

We're in favor of garden structures that don't fall down when the tomatoes or cucumbers mature. A little well-placed concrete makes trellis and fence posts stay where you want them. Get a post hole-digger, some post bases from your locally owned hardware store, and get ready. Dig all the holes, run a string between them to keep the posts in line, and have all the posts and tools ready before you start mixing (the concrete won't wait for you). The key to good, hard cement is slow curing. While setting your posts, and for a day or so after, keep the surface of the concrete watered. And be sure to mark anything that's still hardening with caution tape if there are people around.

Cob, Earth Bag, Straw Bale, and Wattle-and-Daub Construction

Cob is an ancient and worldwide building method in which clay soil, carbonaceous material (such as straw), and sand are mixed together to make the natural equivalent of concrete. Used since time immemorial to make the proverbial mud hut, modern green builders have adapted it for all types of urban farm structures, from sheds to benches to wood-fired ovens. We have been lucky enough to participate in some building projects using cob and found it to be a pleasant if time-consuming activity. A cob bench or toolshed is a lovely thing in an urban farm, but it must be built by someone who knows how or is willing to find out and follow through to the last plaster coat and a roof. If not, the structure will gradually melt in the rain, making a heavy, depressing mess.

While we haven't personally done earth bag, straw bale, or wattle-and-daub construction, we've seen projects that look great. Earth-bag construction is the most intriguing, due to its simplicity and affordability. It involves digging up earth, putting it in bags, and stacking and compacting them to make walls. Depending on the height, various simple methods of reinforcement are used. Windows or doors can even be framed out. We can imagine that earth-bag construction could be easily used to make planter boxes of any size and shape.

Wattles

What are wattles? It's fun to say that word. We're sure it has many meanings, but in this instance we are referring to the jute netting-covered straw sausages that are used to prevent erosion on hillsides and freeway verges. We got this idea from our amazing friend John Bela. John was racking his brain to try to figure out how to build planter beds with locally produced sustainable materials. Since there are wattles made from waste rice straw in California, where he lives, he decided to try them. These flexible sausages can be used to edge beds both curved and straight. Nine-inch-diameter wattles can be stacked and kept in place with wood or rebar stakes. They will eventually decompose, but it will take a long time. A company called Earth Saver makes them in California; there may be an equivalent in your state.

GARDEN PATHWAY MATERIALS

Cardboard

We just cannot believe that people still put cardboard into the landfill! It's made out of trees and is a wonderful resource for many reasons. Nonwaxed used cardboard is a great weed blocker for paths and perennial planting areas. After pernicious weeds are removed, paths can be layered with tape-free, broken-down boxes and covered with mulch. This will keep down weeds.

Users Review

From reader reviews:

Belinda Bedard:

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