



The Horticultural Society of New York

# **GROWING WITH THE GARDEN: A CURRICULUM FOR PRACTICING HORTICULTURE WITH INCARCERATED INDIVIDUALS**



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# Introduction



*To the garden, the world, anew ascending,  
Potent mates, daughters, sons, preluding,  
The love, the life of their bodies, meaning and being,  
Curious, here behold my resurrection, after slumber;  
The revolving cycles, in their wide sweep, have brought me again,  
Amorous, mature – all beautiful to me – all wondrous;  
Walt Whitman. 1819-1892*

## Horticultural Therapy

As early as 1798 the U.S. medical profession touted the healing quality of plants with accounts of patients who, working in the hospital food gardens, recovered more quickly than patients who simply convalesced in their rooms. Sanitariums and psychiatric hospitals began to adopt gardening as an in-house activity for their patients, not only to grow food for institutional consumption, but also to promote healing in the mind and body.

Beyond the simple nourishment of fresh air and exercise, it is now understood that gardening and plant care offer a host of rewards in increasing one's self-esteem, developing job skills and creating avenues of nurturing and self-expression.

The more intangible qualities are related to the very power and deep mystery of nature - a force that in many circles is seen as a vehicle for individual growth and development . Psychiatrist Karl Menninger calls this process adjunctive therapy, which has been seen to help patients with depression, anger and trauma disorders. The serenity involved with designing and constructing a garden along with the work of maintaining it is instrumental in channeling anger and aggression into productive skills and activities .Today, there is a nation-wide movement to incorporate horticultural therapy into various medical facilities with the goal to promote positive and substantive changes in human behavior.

How does this play out in the prison setting? For prisoners, many of whom have suffered frequent failures in the job place, low literacy and the frustrations of being marginalized in society, horticulture is a process that allows them to control their environment through shared responsibilities – an unspoken contract between person and plant. Accomplishment is its own reward, generating new goals, skills and productive efforts in one's life. As skills develop and projects increase, the individual achieves a greater sense of empowerment along with newfound pride in their role in the workplace.

Unlike specific programs in hospitals, drug abuse centers, psychiatric wards, and hospices, prison populations may encompass a whole range of personal disorders, physical ailments and anti-social behavior. Inmates may be incarcerated for crimes they committed, but imprisonment does not address the underlying mental disorders that may have lead to criminal behavior in the first place. With the ground wide open, prison horticulture aims for a common denominator when exploring the potential of each individual and their struggle for change, growth and self-realization. The garden provides an important medium and metaphor for this dynamic process; for what takes place in the garden - work, effort, planning, skill, and an understanding of the various plant, animal and human interactions - is rewarded with creation, beauty and food.

## **STARTING OR EXPANDING A PROGRAM**

### **Statistics for Rikers Island**

- \* Two-thirds of the population is detainees
- \* Male pop 90% of which black/hispanic is 91%
- \* One of eight males and more than one of four females is HIV positive
- \* 14% are asthmatic and 4% diabetic
- \* One in four suffer from psychiatric disorder
- \* One of 10 has serious and persistent mental illness
- \* 75 to 95% of inmates have a history of substance abuse
- \* 10% have a high school diploma
- \* 50 – 70 percent read below a sixth grade level in English
- \* more than one-fourth cannot make bail of \$500
- \* almost 3 of 5 have bails of \$2,000 or less.
- \* On average, inmates spend just a month and a half in the jail system
- \* Half are older than 30
- \* One-fifth between 25 and 29
- \* One-quarter 16 – 24
- \* Highest charge is a felony related to sale or possession
- \* One of eight is robbery
- \* One out of 12 for murder or attempted murder
- \* One of 20 is for burglary
- \* 70% are for felony offenses
- \* 30 for misdemeanor (larceny 3.0%, drugs 2.7% and prostitution 0.1%)
- \* 1992 had an all time high of 21,449 inmates



Therapists with the Garden Project at the San Francisco County Jail have used plant growth and the cycles of nature to emphasize natural and controlled processes of personal growth. Compost is used as a metaphor for life's mistakes and misfortunes and provides meaning that the individual can redirect their path in life to a more productive space. Weeding is equivalent to removing the negative thoughts, patterns of behavior and influences in one's life, while transplanting and watering symbolize the stage of leaving jail and maintaining a productive life outside.

The garden provides a direct hands-on method for individuals to take responsibility for themselves as a natural outgrowth of taking responsibility for a garden. The more one plays a part in their creation and maintenance, the better they are able to apply these concepts to changing their life. In the process, inmates develop important job skills, including construction, gardening and landscape maintenance, interior design, floral arrangement and general management abilities that can help them find employment when they re-enter their communities. Often, gardening programs are based on curricula that lead to certification in different aspects of horticulture, from IPM (integrated pest management), pest control, turf management, tree care, landscape maintenance and plant propagation. For prison officials, horticulture is a way for inmates to release stress in a positive and productive manner.

### **Every Day in the United States**

3	Children die from abuse or neglect
6	Children commit suicide
13	Children are homicide victims
15	Children are killed by firearms
95	Children are arrested
342	Babies are born to teen-age mothers
1,407	Babies are born into poverty
2,660	Children drop out of school
2,833	Children are arrested
6,042	Children are reported abused or neglected
13,076	Public School children are suspended

SOURCE: Children's Defense Fund, "State of the Children" report, 1996

### **After release**

The success of a prison horticulture program is quite dependent on how successfully inmates, once released, carry their lessons and skills back to society. Re-integration is a primary concern for correction officials, funders and legislators concerned with prisoner rehabilitation. Often, the ability of the ex-offender to stay out of jail is dependent on his or her ability to find and hold a job and maintain relationships with members of his or her community. One of the main challenges of any program is a post-release component that develops networks with

employers and programs to help ex-offenders build an independent life away from jail. While almost every state penitentiary system, a number of federal systems and a handful of city jails have horticulture programs, very few work with inmates once they are released. There are however, a number of programs that offer creative solutions to the problem of after-release and employment.

The Garden Project occupies a once abandoned lot that released inmates transformed into a vegetable and herb garden. Ex-offenders from Sneed's gardening program use the lot as a half-way house to congregate, garden, and find avenues of support and employment. Produce harvested from the garden is sold to restaurants in the city, the proceeds of which help pay salaries to the gardeners as well as supports the program. In addition, the Project runs the Tree Corps, a project funded by contracts with the City's Department of Public Works to plant and maintain street trees throughout the city.

The GreenHouse Project, a program at Rikers Island in New York City ties ex-offenders to various positions with greening organizations in the city. The project also partners with South Forty Corporation, a non-profit organization that helps released inmates find positions of employment in the private and public sectors. Unlike federal or even state penitentiaries, city jails, with their, general proximity to urban centers offer countless opportunities for post-release strategies and job placement. The challenges are more inherent with rural-based facilities, which are often located far from the inmates' homes and communities. There are however, different ways project planners can generate job opportunities in city, state and federal sectors as well as find appropriate work placement or job training programs in each state.

## **Jail as community**

The concept of rehabilitation ties into the very role jails and prisons play in society at large and communities specifically. These large, generally expensive facilities are often viewed as resource sinks, lock-ups for unproductive and or dangerous elements of society. Since the code of Hammurabi, which institutionalized the concept of retribution for criminal acts, incarceration has swung back and forth from being punishment-based to rehabilitative. But with over 2 million Americans now incarcerated, it is more important than ever to view incarceration centers as potential resources that will not only produce individuals who can hopefully contribute to society, but generate material benefits for nearby communities.

At Rikers Island, surplus production in food is distributed to homeless shelters and soup kitchens. Plants are grown and propagated for city parks, day care centers, libraries and other public institutions. A 5-million-dollar compost facility recycles jail food waste and turns it into rich organic soil for the New York Parks Department. Inmates build window boxes for public schools and rehabilitate damaged plants that find their way to hospitals and orphanages in New York City. The connection between work and serving the community is an important element in the rehabilitation process for it makes inmates feel lie a productive part of society during their incarceration. As a benefit for the jail, it creates a larger social function than simply removing criminals from the general population.

# Chapter 1: What Students Should Know

*Knowledge is only the first step. True understanding is knowledge filtered through experience.*

*“Home is, in a way, a place to hide and our designed landscapes are about providing ourselves with places; places to be alone or to be alone with a particular person or group. The absolute erasure of this possibility — . . . to be in a personal space — pervades the prison environment”*

— Paula Hayes  
Landscape Designer

## LANDSCAPE AS A TRANSFORMATIVE ROLE IN PRISON ECOLOGY

It is not difficult to imagine the physical environment of the nation’s major jails and prisons: miles of double row fencing topped by razor wire spaced between with buffer zones of gravel, acres of cut grass, the guard towers, the buildings bare of plants, the grounds shorn of color. The bleakness of the prison landscape has its purpose, trees and landscaped buildings can obscure sight lines, creating issues of security, but there’s the psychological impact as well. The grim surroundings mirror the harshness which incarceration attempts to impose on criminal offenders. There is little evidence, however, that recidivism rates are lessened by the overall jail environment, nor does it generate or offset the sense of futility inmates experience during their incarceration. Most inmates in the U.S. will be released at some point in their lives and the futility they experience in jail will accompany them to their homes and communities.

Prison gardening and horticulture can alter the jail’s physical landscape while transforming the inmate’s personal environment. This interaction plays a major role in defining prison ecology as a series of meaningful and positive relationships between people, culture and nature. The inmate who plants trees that provide food and habitat for birds, or perennials that sustain larvae of a specific butterfly, or herbs that were used by a parent for cooking, connects to the environment in a manner which transcends the tasks involved with grounds maintenance or beautification. The act of planting not only becomes a personal experience, but, the decision of what to plant provides an avenue of self-expression and empowerment. The process results in a prison environment that is also more conducive to the control and care of offenders, and a less stressful workspace for the staff and officers.



**Fig. 1. Transforming the Landscape**  
Fulfilling the potential in a person or place sometimes requires the willingness to look past the apparent desolation of the moment.

## THE CREATIVE PROCESS

Landscape design is a process initiated in both the mental and physical realms. Creativity, a physical space where inmates can implement and install their ideas, along with some working knowledge of design principles are three essential elements for a landscape program. The metaphors are poignant; from designing paths, to creating gardens which mimic processes found in natural systems to establishing boundaries and entranceways, design takes on the psychological contours of our own needs and desires.

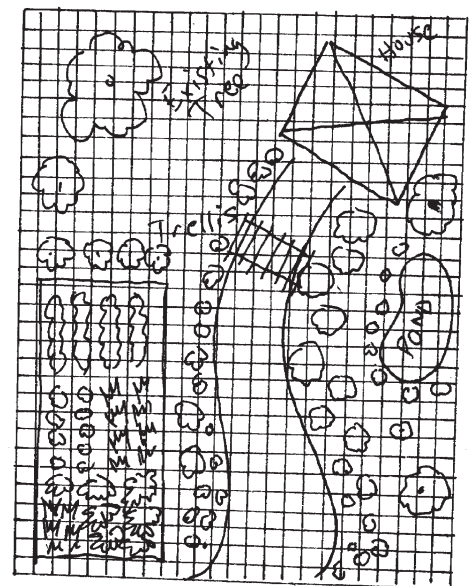
Design starts with a blank piece of paper and a bare space of earth. Students will ask themselves: What are the relevant features of the site? How does one create beauty and its attendant natural functions? What purpose does it fill to benefit people and wildlife; what is its use? These are relevant questions they can ask about their own lives. Yet, here the answers are forthcoming based on the students' working knowledge of plants, their personal aesthetics and site design. The next step is examining set features in the landscape. The position and movement of the sun, the site's access to water, its slope, and soil type are all important elements the students must consider in shaping the land to its intended purpose. The shape and aesthetics of design are the next stage of site development. Will the garden or planted area have curves and edging, berms and contours, multiple layers of height, a variety of colors? Will there be complementary structures, access, shade and symmetry? What is the vision the students hope to create? And ultimately, who will experience the end result? Officers, staff, visitors and other inmates are all part of the prison environment and their understanding and enjoyment of this process help build the self-esteem of the inmates responsible for its creation.

With the answers at hand, the students can develop their preliminary sketches. They can focus on the future, imagining how the site will develop, the growth and structure of the plants they choose, the color of their flowers and texture of the foliage.

We often say that landscape is the ultimate painting and sculpture, a three-dimensional art piece by an artist whose technique is based on a working knowledge of science. Every plant has an appropriate place based on its function and adaptation to an ecological niche. Some survive better than others. Some will colonize and exploit a site eventually spreading out with their roots or taking over in successive years through the dispersal of multitudinous seeds. Others are exotic and need excessive care. Trees create micro-climates and habitats that can alter a site dramatically and create new opportunities for diversity and plant structure. Herbs not only provide fragrance and color, but are used as traditional medicines, salves and food by different cultures world-wide. All of these elements come together in the garden. As students understand the characteristics of different plant species and varieties: their growth rates and size, their specific flowers and fruit, their structure and foliage and their specific niche in the garden, there becomes a close assimilation of their own development and growth.

The ability to control nature is inherent in gardening, but control is balanced with the need to minimize maintenance and provide opportunities for plants to naturalize and sustain themselves over time. A well-designed garden is a social contract with nature, a balance between art and the environment. This relationship, together with an accumulating bank of knowledge and skill, are the ingredients necessary for bringing about one's overall vision.

**Fig.2. Measure carefully allowing one foot to equal one box of 1/4 inch graph paper. Start with an existing feature and take many measurements to establish the principal points of your design. Refer back to your original feature as much as possible.**



## **The process of design: the prison experience**

*By Paula Hayes*

The usual cultural padding we associate with institutions or communities and neighborhoods does not exist in the prison landscape. Nothing seems to be decorated or celebrated. Driving onto and across Rikers Island casts an immediate feeling and a physical reality that there is no place to hide.

Home is, in a way, a place to hide and our designed landscapes are about providing ourselves with places; places to be alone or to be alone with a particular person or group. The absolute erasure of this possibility — to go somewhere, to hide, to be in a personal space — pervades the prison environment.

On Rikers, within this relentlessly exposed landscape, exists a radically different approach to our perceived sense of incarceration. Deep within the complex of facilities, checkpoints and fencelines is the prison garden and greenhouse where the jail holds its program, and, where I was invited to teach a day's course in landscape design. Clearly, the greenhouse and grounds were an oasis for the inmates involved. Under the shade of a massive crab apple tree were benches and tools for gardening. It was summer and the tended areas were flowering and attracting birds and bees. Water was flowing; all was nurtured and cultivated.

I entered the greenhouse classroom where a group of women were waiting for me. They seemed tired (many of the women at Rikers are incarcerated for drug use and are medicated or on methadone), but clearly glad to be outside; the door was open to the breeze outdoors. I began talking about what I imagined to be the most difficult aspect of their time in jail: the inability to be alone, unwatched, to restore themselves on their own quiet terms. I tried to equate gardening and gardening design with the process of self-creation: for by being highly and patiently attentive and by responding to the subtle movements of growth is the core to providing oneself with a private arena to lead an explored life. To be in the landscape — in relation to moving through it and using its provisions-enlivens us as caretakers, not only of the earth but also of ourselves.

We talked about design elements for a garden the women were creating in memory of an instructor who had passed away. We drew sketches on the blackboard examining entranceways and exits and pathways through the garden. We talked about boundaries and private spaces; how gardens can create a series of separate rooms that can be either real (using hedges) or illusionary (through borders). We looked for meaning in shape, color, texture and fragrance. We then went outside. The students clearly wanted to move and work. We measured and laid out our plants and pathways according to the sketch. We watered the new plantings. By the time we had finished I really felt that having this chance to build the garden was a profound and lasting experience for all of us.

Paula Hayes is a New York City-based landscape designer and artist who has created projects in the U.S. and Europe



## ECOLOGY AND THE NATURAL GARDEN

### What is an Ecosystem

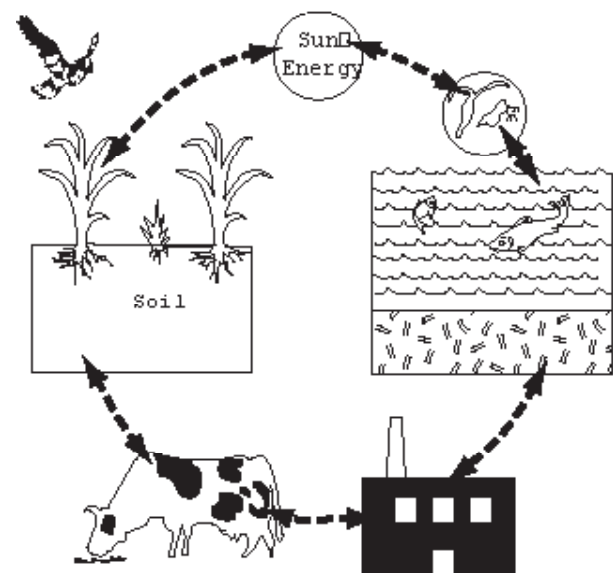
The survival of life is based on beneficial relationships between plants and animals in all types of ecological systems and environments. These systems encompass the wide variety of the earth's deserts, oceans, tropical rainforests, temperate forests, alpine, tundra, even cities, and involve organisms as complex as humans and as simple as microscopic protozoa and bacteria. The relationships between plants and animals form complex interdependent communities which secures their ability to adapt and survive in a given environment. Food chains are the driving force of ecosystems, typically beginning with the plant world which derives its food source from the sun, and its nutrients from the soil. Food chains are the key to nutrient recycling, allowing energy in the form of carbohydrates, glucose and nutrients to pass through and sustain a system.

### Nutrient recycling in a small-scale community.

Bacteria lining the stomach of the cow allow it to digest plant foods, which in turn provides carnivores (meat-eating animals) with a source of meat, and humans with milk among other products. Manure from the cow is returned back to the earth's soil and broken down by soil bacteria and other microorganisms into nutrients that are used by plants, which in turn are eaten by cows.

One of the more dramatic ecosystems on earth is the East African savannah, a grassland system that supports millions of different herbivores such as zebras, giraffes, wildebeest and a variety of antelope species. These in turn are prey for carnivores like the lions, leopards and cheetahs. The carnivores are followed by hyenas, jackals or vultures which scavenge the kill remains, or feed on dead and dying herbivores. Over time, trees would eventually grow and shade out the grass, changing the grassland ecosystem into an emerging forest system. Disturbances prevent such changes. Fire periodically sweeps through the grasslands destroying larger plants like trees. While the grass is burned on the soil surface, their thick mat of underground roots is still alive. Nutrients from ash (as well as from manure deposited by millions of herbivores) are released into the soil and when mixed with rain generate a lush new carpet of growth. Elephants also shape and maintain the Savannah by knocking down trees and stripping them of vegetation. Other elephant habits such as rolling in mud help create small ponds and watering holes that are used by other animals in the ecosystem. Because grass grows more quickly than woody shrubs and trees, it is able to support much greater numbers of large animals than woodlands or forests.

Gardens are a far cry in structural appearance from the African savannah, but as functioning systems there are profound similarities between the two. Energy in the form of recycled chemicals is still moving through a complex of animal and plant interactions. In gardens, however, humans replace elephants and fire as the disturbance regime shaping and sustaining the system. Yet, the role humans play in maintaining these sites can be far apart or close to the way nature sustains itself. The way people garden may not only influence the system's micro-ecology, but also can have negative or positive impacts on the regional ecology.



**Fig. 3. Ecosystems**

Everything including a prison is part of an ecosystem

## THE GARDEN AS A HUMAN-MADE SYSTEM (NON-ORGANIC)

Non-organic gardening, typically for vegetable and food production, lawn care or the growing of exotic plants for beautification depends entirely on human labor and inputs. Each year the earth is turned, plants are either grown by seed or transplanted as small plants into the garden bed. Fertilizer, in the form of store-bought manures or synthetic chemicals are added to the garden as plant nutrients. Weeds (which also includes tree seedlings) competing with desirable plants for food, light and water, are removed by hand or eradicated with herbicides, and insects which consume the leaves and fruit of garden plants are sprayed with chemical pesticides. Non-native plants and sterile hybridized varieties are not only care intensive, but offer little food and resources to native birds and wildlife.

The wide-scale use of herbicides and pesticides create harmful conditions in the local environment. As chemicals, they can leach out into nearby water systems contaminating drinking supplies or harming aquatic wildlife. Pesticides not only eliminate harmful insects, but any other insects that are needed in the garden, including butterflies and bees which are major pollinators, ladybugs and praying mantis that feed on and



### What's in Americas landfill — Increase of suburban development

By carelessly disposing of certain materials we are creating land fill which can take 100s of thousands of years to decompose

**Tin can** — 100 years

**Aluminum can** — 500 years

**Glass bottles** — as much as 1, 000,000 years

Landfills are reaching capacity fast. An estimated 1/4 of what we throw away can be recycled. Yard and garden waste account for about 20% of the contents of America's garbage cans second only to paper at about 36% with food at about 9% — all recyclable materials.\*

Even though most plastic will not decompose it is all recyclable. Almost all metals can be recycled. But 20 thousand cars end up in our landfills every year. Still only about 20% of the paper used is recycled.

Even a traffic ticket can take a month to decompose in a landfill. Americans buy (and throw away) 500 million disposable lighters every year. In the early 80s millions of tons of hazardous waste were generated — more than a ton for every person in the United States. It takes over 50 thousand trees to supply the pulp for America's Sunday papers. \*\*

\* Source: *Characterization of Municipal Waste in the United States 1960 to 2000*, Franklin Associates LTD.

Source: *50 Simple Things You Can Do to Save the Earth*, 1989 Earthworks Press. Berkeley, California.

control harmful insects, earthworms and small soil animals (microorganisms) that break down organic matter into nutrients for plants.

These inputs are costly in terms of money, labor and the well-being of the regional environment. For example, Chesapeake Bay, an estuary system once described by the writer H.L. Mencken as a “virtual protein factory,” is virtually choking to death from the proliferation of algae and the loss of native bay grass. Most of the crabs and oysters are gone; and fishing, as an industry, has disappeared. Excessive nutrient and silt run-off from surrounding farms and the increase of suburban developments has seriously impacted the Bay’s ecology.

## **THE GARDEN AS A NATURAL SYSTEM**

Landscaping and gardening should not only be environmentally sound, but also should increase and add to the health and vitality of the regional ecology. Natural systems of gardening depend on the same type of inputs as non-organic man-made gardens, such as fertilizers, new plants, seed dispersal, pest control and watering. The difference is that natural systems are self-supporting. They have built-in systems that maintain their development and survival and which mimic the processes which occur in nature.

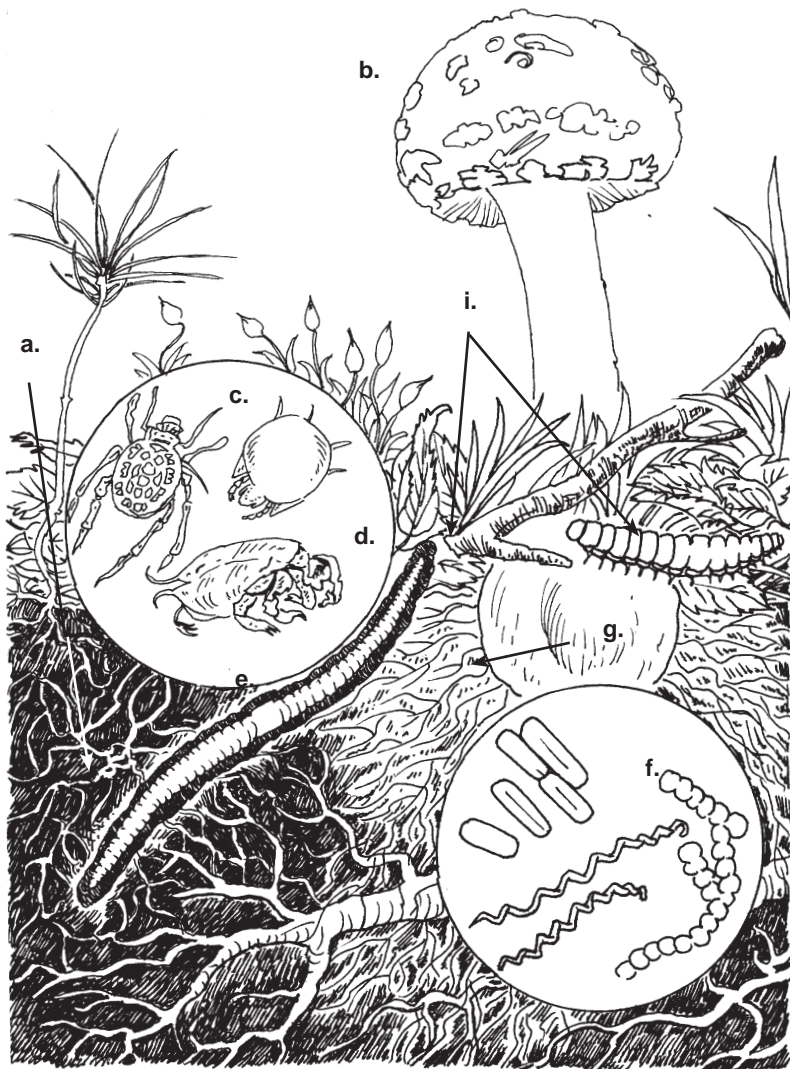
Walk in a forest. That spongy ground underfoot is decaying leaves and twigs that is turning into humus — decaying organic matter that improves fertility in the soil. This spongy material insulates the soil from the cold, keeping plant roots warm during winter. In the summer, the spongy material, known as duff, keeps water from evaporating from the soil, keeps plant roots cool, and prevents soil compaction. Finally, it serves as a home and food source to millions of earthworms, beetles, and grubs as well as trillions of microscopic soil organisms, all of which are instrumental in helping litter (twigs and leaves) decompose into nutrients for plants.

Covering the soil with an organic mulch is the first step to creating a low-input, self-supporting system. Exposed soil is a welcome bed for weed seeds that germinate easily and grow in such conditions. Compaction is another problem. When objects as large as gardeners or as small as falling raindrops tread on bare soil, the surface, becomes compacted over-time. This condition can transform fluffy, porous soil into a surface like concrete, preventing water and air from penetrating the soil – two elements that roots need for plant survival. Lastly, the absence of an organic soil cover means there is no raw material than can be broken down into plant nutrients.

By mulching our garden with woodchips, dried leaves, grass and other plant materials, we create the same spongy layer that is found in our grasslands and forests. This layer is broken down by soil organisms much more slowly than commercially prepared fertilizers and is less likely to leach from the soil into the water table. Mulch prevents the soil from drying out in summer. It keeps plant roots warm in the winter, and helps suppress competing weeds. Simple woodchips are one of the most important materials used for keeping the garden productive and the environment healthy.

By creating an environment that helps control or eliminate insect pests naturally we can eliminate the need for chemical and harmful pesticides. Pesticides not only eliminate pests but also the types of insects that are necessary for any healthy garden. Birds and insects such as ladybugs, a variety of wasps, the praying mantis, lacewings and big-eyed bugs eat many insects that are harmful to garden plants.

Use a good outdoor gardening book to identify bugs you see in the garden. Are they harmful to plants or beneficial. Do they eat plants or insects? Do they pollinate flowers? Other insects such as butterflies not only add beauty to the garden but along with bees, are important pollinators that fertilize fruits and flowers for seed production. By understanding the life cycles and food sources of beneficial insects we can plant the types of flowers, shrubs and trees that support their population and create a more dynamic and sustainable system.



**Fig. 4 Forest Ecology**

a. More research is needed to learn how mycorrhizal fungi mediate interaction among different tree species. A fungus forms a mycorrhizae with one tree, then extends its hyphae into the soil and forms mycorrhizae with surrounding trees. This directly links the trees to each other.

b. Some fungi like toadstools have hundreds of underground threads. They take nutrition from tree roots and in turn make soil more fertile.

c. Oribatid mites are a diverse group of microbial feeders. 1 square meter of forest can support 200 thousand individuals.

d. Peltenuiala, a litter dwelling mite.

e. Arboreal microfeeders attain high numbers in forest areas.

f. Millipedes grazing on pine needles mix the plant cells with bacteria in their own gut.

g. The main part of the fungi are the underground threads.

h. The important leaf litter layer.

i. Cyanide produced by the millipedes surface cells used to defend against predators is a regulator of forest nutrition cycles. Worms drag fallen leaves underground where they rot and release nutrients.

## DESIGN FOR BIODIVERSITY

The more variety of plants in a garden, the more types of natural checks there are on insects and plant diseases. For example, different plant species such as marigolds or lavender emit chemicals as a defense against pests, if planted near defenseless neighbors they can help prevent the movement of insects, fungus or diseases from plant to plant that would soon infest the entire garden. Birds need thick shrubs or trees to build their nests. By planting them near or in the garden, birds which feed on insects are likely to be major factors in pest control. Large and small size perennial flowers, grass, different trees and shrubs provide food and shelter through the winter. This variety in structure also effects light and temperature, forming micro-habitats that support different types of animals, both above and below ground; in effect, increasing the biodiversity of your garden system.

Biodiversity relates to all the different plant and animal species that are part of a healthy ecosystem the genetic checks and balances of a functioning system. Unlike natural ecosystems, which can take several months or thousands of years to evolve, gardening systems are not only manipulated into place by the plants chosen for the garden, but the sites in which they are planted. Choosing for diversity generates a more dynamic system – of foli-



age, grass, trees, herbs and varieties of plants that flower at differing times in the season. In addition, bird and insect combinations provide year round interest and beauty.

Humans have long played a decisive role in shaping their environment to promote diversity. In New England the Native Americans controlled the thick stands of old growth forest with periodic burns. This created a mosaic of openings and meadows and forests in different stages of regrowth, which in turn supported greater numbers of game for them to hunt. Many of the “pristine” forests in the Central American jungles are nothing more than overgrown kitchen gardens established by the Mayan Indians centuries ago.

Our ancestors realized even then that diversity in gardening was a prosperous route to survival. It has only been with the rise of industrialized technology that humans have altered their environment in ways which now threaten the long-term stability of the earth’s vital systems; its water, air and soil. Promoting healthy land use systems in sites as small or large as prison gardens helps inmates understand the greater need to be effective stewards of our planet’s resources; it connects them to their role as caretakers of a fragile and often-threatened system.

### **Plants that promote natural pest control**

Tansy  
Fennel  
Clover  
White cosmos  
Herbs such as spearmint, lemon balm, dill and buckwheat

### **Steps we can take to promote natural systems for diversity and wildlife**

Plant native plants that have already adapted to local site and therefore, need less care and non-hybrids that produce berries and other edible fruits. Use plant layering and include diversity in your garden.



**Fig. 5. Steps we can take to promote natural systems.**

After working in the garden for a while students began to recognize that the integrity of a natural area depends of complex processes. These processes depend not only on what is occurring within the boundaries of the garden but are also driven by what occurs in the world around it. The lesson is that if we are going to preserve natural areas whether managed or reserve we have to understand the systems that are in operation in the area. It is not enough to simply put up a fence around it. The problem is complex but urgent.



# Chapter 2: Understanding Plants

*The garden is a miniature, a slice of nature compressed in space, and a pattern of information compressed in time.*



## Understanding Plants

**T**he 260,000 known species of plants form a diverse and complex group of organisms that can be as simple and small as microscopic algae or as large as a 300 foot tall redwood. Plants are the oldest living things on earth; some bristlecone pines in California's Sierra Mountains are estimated to be over 10,000 years old. In their evolution, plants have formed complex chemical compounds, many of which defy human attempts to replicate their structures in laboratories. In the past few years over 10,000 different chemical properties have been isolated from the tissues of plants. Many of these compounds provide the ingredients to important medicines, polymers, resins, fragrances, spices and products that have spurred human exploration and technology since the rise of early humans.

Despite the evolutionary adaptation and development of the plant world, most plants share a similar anatomy. A honeysuckle vine for example, may seem far removed from an oak tree, but all the components which provide their basic needs are alike.



### When Planting or Transplanting: watch for roots

The easiest way to kill a plant is to expose its roots to wind, air and sun, which will quickly dry the small tiny hairs responsible for absorbing nutrients and water. When transplanting, make sure to keep the roots in the root ball moist, and create contact with the soil as soon as possible. Plants with taproots are more difficult to transplant; severing this root will kill the plant. An exception is the hardy dandelion which can regrow from root remains.

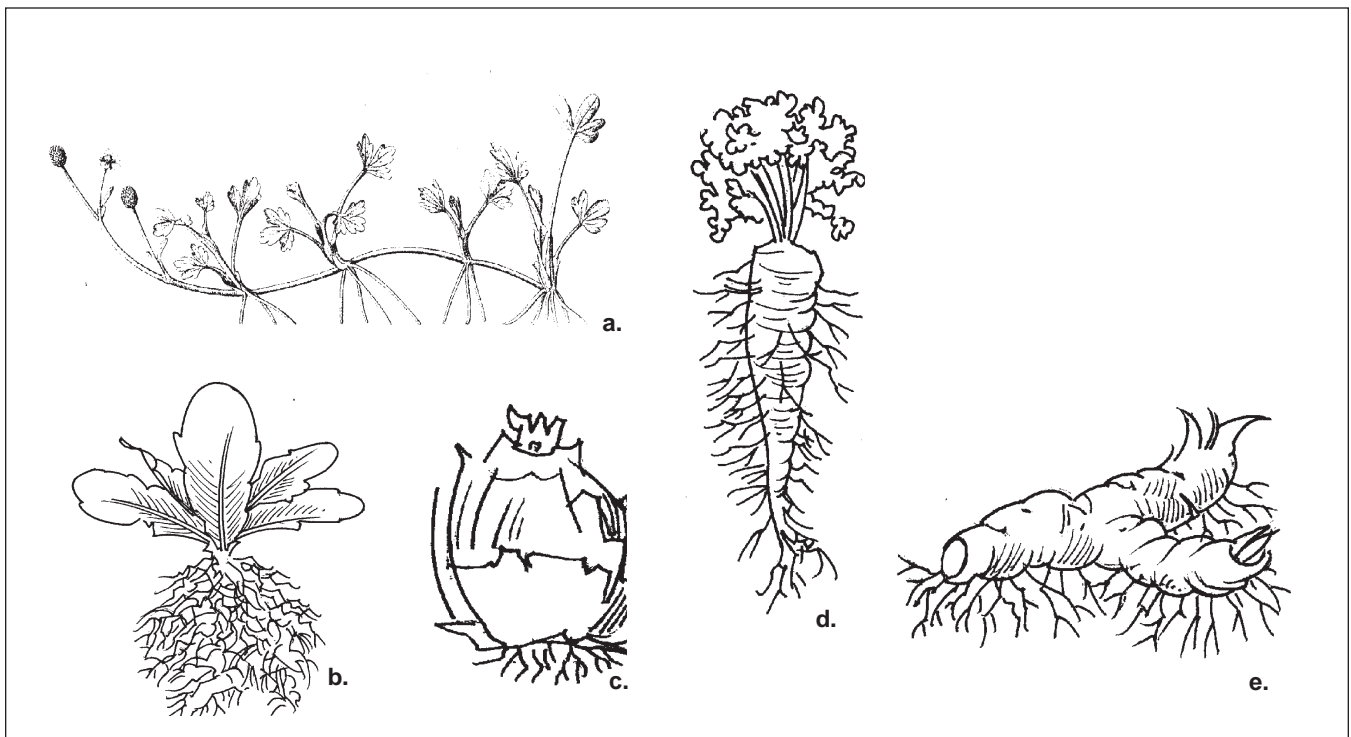
Houseplants are equally susceptible to root rot which generally occurs from too much watering. Inadequate drainage and over-watering are major causes of plant mortality.

## Roots

Roots anchor the plant to the earth and are responsible for absorbing water and dissolved nutrients from the soil. The first tissue to emerge from a germinating seed is the radicle, the plant's first root which pushes downwards to form the primary root. From the radicle, emerges what is called secondary roots which branch out and begin to penetrate and spread through the soil.

The development of roots is highly dependent on the level and type of moisture plants receive early on. Deep watering allows roots to strengthen underground while surface moisture tends to send them out horizontally. Generally, plant roots have as much volume below ground as the plant above ground and can extend as far out as the ends of branches, an area commonly referred to as the drip line. During times of drought, the fine secondary roots that grow in the top 6 to 8 inches of soil can die quickly, leaving the plant dependent on its deeper roots. Without a well-developed root system, plants are especially susceptible to dry spells.

The structure and formation of roots reflect the environmental conditions which shaped the plant's development. Plants in arid areas tend to have deep taproots which can seek out stored water underground. Tropical rainforest species which evolved in a highly competitive ecosystem have a variety of roots: fibrous roots which spread across the top soil layers quickly absorbing available nutrients, buttressing or aerial roots which can anchor tall trees in wet soils and roots of epiphytic plants that cling to branches and are able to quickly absorb nutrient-rich rainwater flowing on the bark of their host plant.



**Fig. 1. a. Adventitious (strawberry); b. Fibrous (kale); c. Bulb (narcissus); d. Taproot (carrot); e. Rhizome (iris).**

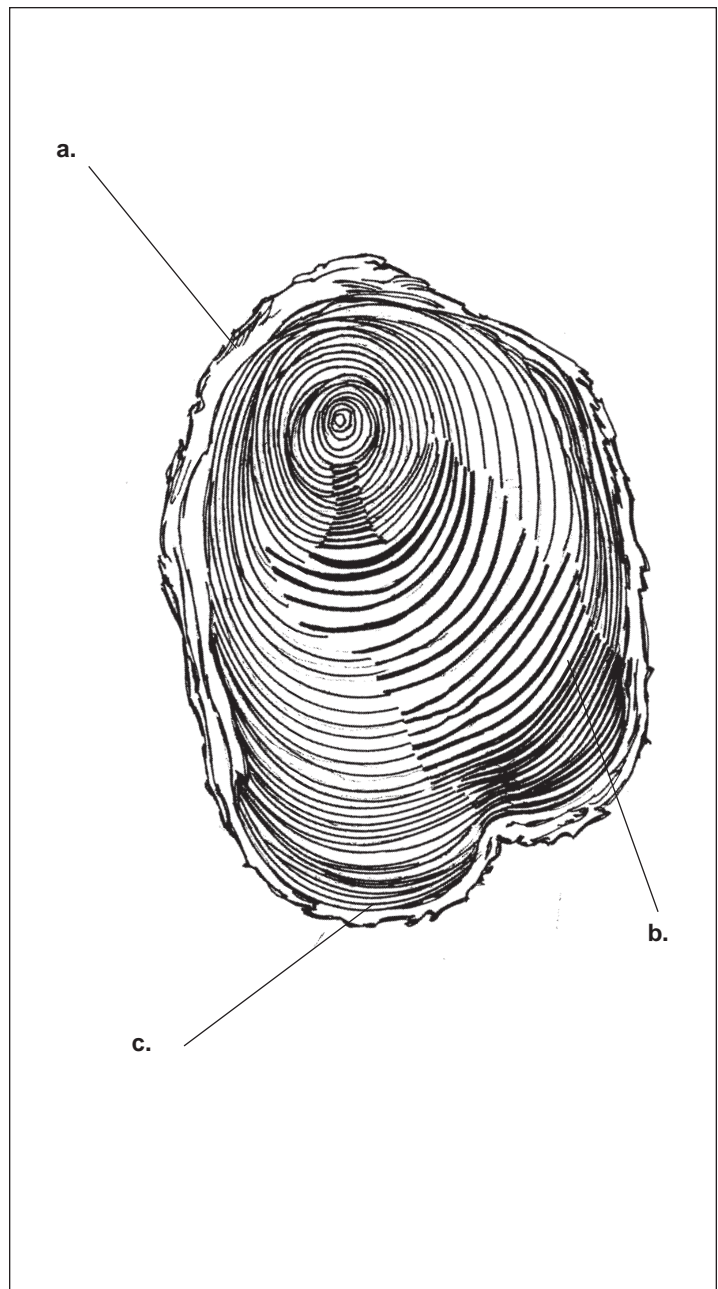
## Stems

Stems can be either herbaceous or woody but both serve the purpose of supporting the plant by transporting water and nutrients to the leaves, and dissolving food to the rest of the plant. The stem tissue is known as the vascular system and consists of two basic cell layers: the xylem which conducts water and nutrients from the roots; and the phloem which transports carbohydrates from the leaves to the roots, stem, storage and reproductive organs. In woody plants, xylem cells have thick cellulose walls of lignin which, when the cells expire, compress and form the actual wood. Not only do these cells provide structural support for the plant, but they also provide storage space for food and secondary products such as oils and resins.

Unlike the xylem, phloem cells die each year and are absorbed into the bark's inner layer while new living cells are produced. The bark, which grows outward from the phloem, helps protect the tree from predators, structural damage and water loss.

Woody plants develop yearly growth from meristems which are found either at the stem or root tips (apical meristem) or on the sides of roots and stems (lateral meristems). Apical meristems are responsible for vertical growth or stem elongation, while lateral meristems produce secondary growth such as bark, and are responsible for increasing the plant's girth.

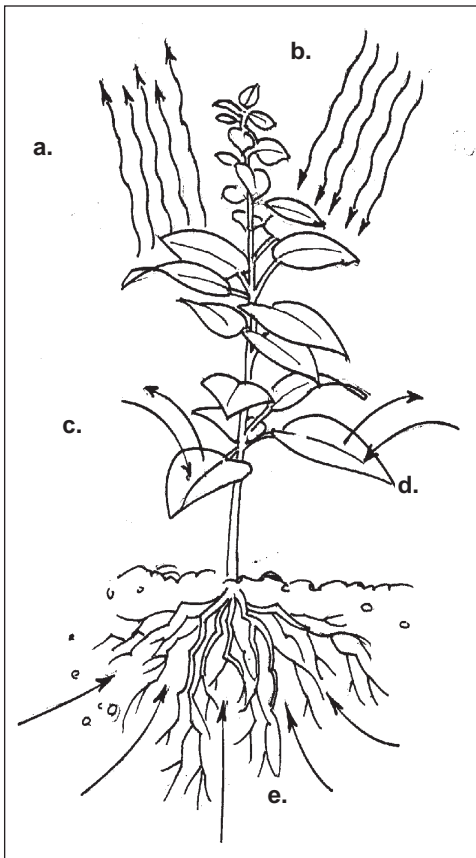
Stems may serve other functions for the plant as well. Thorns and bristles are modified stems that protect the plant from predators. Other plants such as certain cacti store water in their stems or carry out photosynthesis in the absence of true leaves. Vines often have tendrils which allow the plant to grip surfaces and climb, while plants like strawberries have runners or stolons which creep along the ground's surface and take root.



**Fig. 2. Tree rings. a. bark  
b. rapid growth;  
c. slow growth.**

## Discoveries of Photosynthesis

In 1648 the Flemish plant physiologist Johannes Baptista van Helmont planted a 5-pound willow in 200 pounds of soil. After five years he removed the willow and found that it weighed 169 pounds, 3 ounces. Reweighing the soil after it had dried, he found that it now weighed 199 pounds 14 ounces. In other words, 164 pounds 3 ounces of willow was produced by only 2 ounces of soil. How could this be? Did the plant create its bulk from thin air?



**Fig. 3. Photosynthesis and Plant Growth**

- a. Transpiration (water release)**
- b. Sunlight absorption**
- c/d. Oxygen and CO<sub>2</sub> exchange**
- e. Nutrient and H<sub>2</sub>O absorption**

## Leaves

The leaf is nature's most artful and dramatic form of high technology, for in it contains the chemical process which not only converts raw sunlight into carbohydrates, but produces oxygen, and is a factor in the earth's hydrologic cycle. In other words, without the leaf, most life forms on earth would not exist. This process, called photosynthesis, begins when light strikes the leaf's surface and is absorbed by chlorophyll, the green pigment and chemical compound responsible for the leaf's color.

The chlorophyll triggers a chemical reaction with carbon dioxide (CO<sub>2</sub>) that enters through valve-like pores in the leaf's epidermis called stomata. Water, moving in a continuous stream from the plant's roots to the leaf's surface by capillary action, combines with the CO<sub>2</sub>. The result of this reaction is the production of carbohydrates which are transported downwards by the phloem to the rest of the plant. Oxygen, a by-product of photosynthesis, is then released through the stomata to the atmosphere.

Water is also released to the atmosphere through the leaf's stomata, a process called transpiration. Each time the stomata opens to absorb carbon dioxide, moisture is released from the plant. Often it is a delicate balancing act between the conservation of moisture and the intake of carbon dioxide. During drought periods or in areas of low moisture, plants have special adaptations which allow their leaves to regulate moisture loss, while maximizing their intake of carbon dioxide. Often the stomata may close on hot dry days, in heavy winds or when the soil becomes dry.

## Exercise 1. Photosynthesis

Source: Monica Hannaman, Horticultural Society of New York Apple Seed Program

### Materials:

- \* water plant (Elodia) available in pet stores
- \* glass jars
- \* seeds, soil, containers

### Procedure:

- \* Research the way in which plants make their own food.
- \* Set up this photosynthesis experiment
  - A. Take a piece of the water plant (Elodea) and place it tip first into a slim glass jar filled with water.
  - B. Turn the slim jar upside down in a container half filled with water
  - C. Place the container and the slim jar in a bright light.
  - D. If photosynthesis occurs sunlight will be absorbed by the green chlorophyll of the leaves and combine with the water and carbon dioxide so that oxygen will be produced as a by-product. The bubbles that appear on the leaves are caused by respiration.

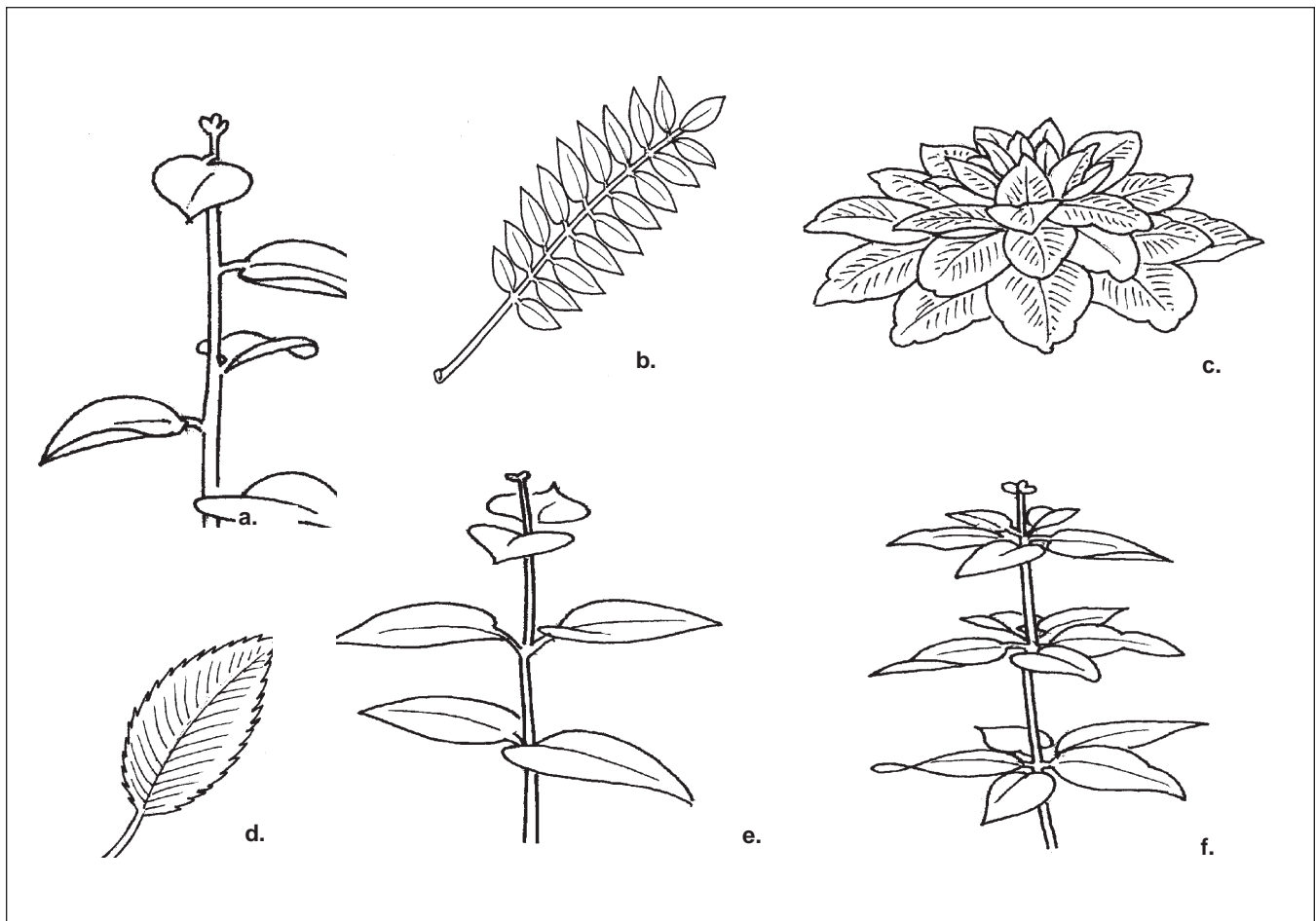
## Leaf Shapes

Leaf shapes are also adapted to utilize low or high levels of light. For example, in areas of high rainfall and thick vegetation like the rainforest, thin leaves with high surface areas – and thus numerous stomata – are able to capture available light in low understory conditions without the threat of desiccation (drying out).

Thick leaved plants, leaves with a low surface area or leaves with epidermal hairs are specially adapted to climates with extreme sunlight and low moisture levels. Succulent plants like the jade and aloe actually store water in their leaves for use during dry periods. Cacti spines are modified leaves that not only offer protection, but also because of their diminished surface area are able to conserve water.

## Leaf Types

The different types of leaf shapes, their texture and veining, their arrangement on the stem, whether they are deciduous or evergreen are all traits that are valuable in classifying plants. Students should familiarize themselves with some of the following major leaf types:



**Fig. 5. Leaf Types. a. Alternate (bush bean); b. Compound (ash); c. Roseate (lettuce); d. Simple (birch); e. Opposite (mint); f. Whorled (bedstraw).**



## FLOWERS AND REPRODUCTION

Flowers, in their manifold and varied forms, are relatively late-comers on the evolutionary scale, but their purpose is singular: to court pollinating insects and animals for reproduction. Attracting mobile creatures as go-betweens in the sexual act, spreads the genes from the mother plant and ensures its genetic diversity. The result is an elaborate display of color, scent and shape, each occupying a particular niche in the animal world. A majority of flowering plants produce nectar, a food source which attracts bees, butterflies, bats and hummingbirds. Others, like the skunk cabbage, emit an odor of decaying meat to attract flies and beetles. In each case, the insect or animal leaves the flower with a bit of pollen that is brought to the next plant they visit. This process is called cross-pollination.



Fig. 7. a. Petal; Sepal; c. bud; d. stem; e. leaf; f. Ovule (cross section); g. Anther; h. Stamen; i. Ovary; j. Style;

### Exercise 2 Plant Dissection

Source: Pam Ito, Horticultural Society of New York  
Apple Seed Program

#### Materials:

- \* Fresh flowers (gladiolas or tulips)
- \* Magnifying glasses, paper towels, scissors, glue, card stock
- \* Botany or biology Book

#### Procedure:

- \* Research the purposes and parts of a flower
- \* Dissect a flower:
  - A. Spread paper towels on the desks and pass out the previously collected fresh flowers. Each student will have one flower.
  - B. As a class, we will identify and cut out the various parts of the flower.
  - C. It is important not to destroy the parts because we will use the flowerparts for our diagram.
- \* Now we will use the actual flower parts to make a diagram. Students glue the parts of the flower to the card stock, label the parts, and write a short explanation of the flower part diagram to explain function of the parts of the flower.
- \* Later: Students will look for parts in different flowers around their garden, or pictures.

The petals are the most visible portion of the flower and have evolved specific shapes and colors to attract pollinators. Some petals have striped markings that, seen from the air by a bee, resemble landing strips. Flowers from the trumpet vine are shaped specifically for the long sharp beak of the hummingbird and there are flowers that open only at night, which are white to attract moth pollinators. There are flowers of certain nectar-less orchids that resemble the flowers of nectar-bearing plants. Insects visiting these flowers are generally unrewarded but they always leave with some of the plant's valuable pollen.

The sepals surround the base of the flower and help support the petals. Often they are the protective covering of the bud before it opens. The corolla is formed by the petals and contains the stamen (male part) which produces pollen, and the pistil (female part) which is connected to the seed producing ovule. Pollen, released from the anvil-shaped anthers of the stamen, will eventually make contact with the stigma, the sticky top portion of the pistil. The pollen will then make its way down the pistil to fertilize the eggs in the ovary.

Most flowering plants contain both stamens and pistils. Often the stamen produces pollen before the stigma is fully developed. This staggered arrangement helps prevent self-pollination. Other plants such as the ginkgo tree, holly species, the witchhazel, contain only the female or male flower. These plants are known as dioecious (Greek for two house), while the former is called monieocious (one house). After fertilization, the petals generally fade and fall off, and energy is transferred into the production of seeds, heralding a new generation of plant.

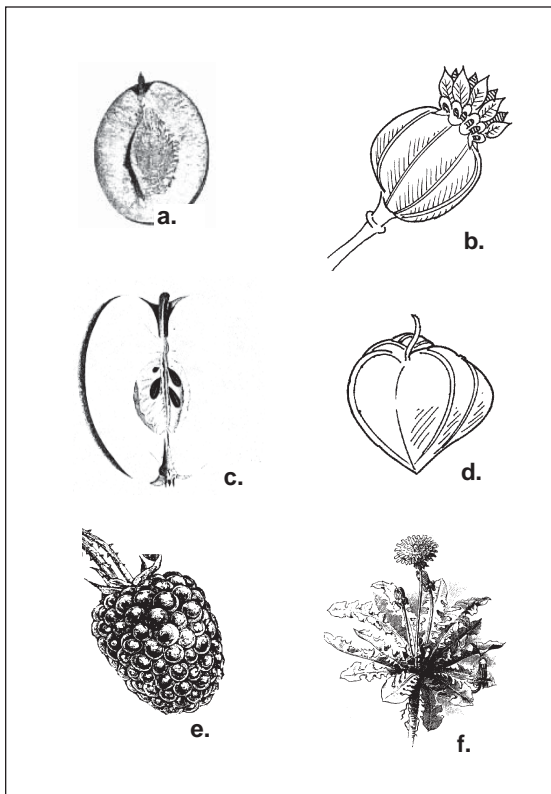
## Seed and Dispersal

The plant's effort to ensure the survival of its seed until it germinates results in the elaborate production of seed coats, stored energy and dispersal mechanisms. The variety of seed forms is generally a function of the plant's specific niche in the environment. For example, some seeds in the pine family can only germinate under extreme heat, and are thereby reliant on periodic fire – a disturbance feature particular to that forest system. The burns eradicate competing vegetation and return valuable nutrients to the soil which are taken up by the seedlings.

Other seeds need moisture or an animal's digestive acids for the seed coat to soften and the plant to germinate.

Dispersal also plays a role in shaping the diversity and type of seed forms. The further away seeds are transported from the mother plant, the less competition there will be and the better chance for survival the seeds will have to germinate and survive.

Many seeds are wind dispersed and have adapted mechanisms that help propel them through the air, like the wings on ash and maple seeds, or the feathery tufts of the milkweed and kaopak tree. Some seeds rely on wandering animals for dispersal; small hooks cling to their fur with the adhesive of velcro. And of course, many seeds come wrapped in a fleshy coat called the pericarp – a source of nutritious food. Birds and animals ingest the fruit then pass the hard seed coat through

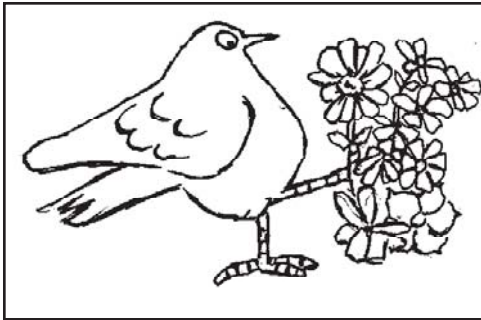


**Fig. 8. Seeds which are contained within a fruit. a. Plum; b. Poppy; c. Apple; d. Husk Tomato; e. Blakberry; f. Dandelion**

their systems at a distance from the mother tree.

Other seeds such as nuts are consumed entirely. To overcome this, certain plants have mast years, where seeds are produced and dropped in such great quantities that many lie undisturbed by the existing population of animals. Squirrels will bury, then later consume and digest the entire nut of an acorn. Sometimes the buried nut is forgotten allowing it to germinate the following spring.

## SEED LONGEVITY



Charles Darwin was able to germinate dozens of varieties of seeds that he had scraped from the foot of a seabird

Seeds have the amazing ability to remain in a state of suspended animation wherever they land and by whatever method they have been dispersed. Indeed many seeds require this period of dormancy in order to insure that they do not germinate during a period of inclement weather. Special handling is necessary to simulate the conditions needed to get these seeds to grow. While some seeds remain viable for only a few weeks or even days there are many seeds that can remain dormant for years. Scientists

believe that it is the seed coat that allows the seed to remain viable for so long. Sometimes the outer and inner coatings of waxes and fats make our job more difficult. Special measures may be necessary to prompt a seed to germinate. Mostly however this works to our advantage as was the case at our own facility where it was necessary to store seeds for months and in some cases years before they could be planted.

## Wind Dispersal

Many species of trees, most grasses and some flowers still depend on wind to disperse their pollen. These plants have very small, almost indistinguishable flowers. The energy the plant saves on producing elaborate flowers is channeled into sperm production. Packed with nitrogen-rich proteins, fats, nucleic acids and vitamins, pollen is costly to produce. Wind dispersed plants need to produce a great quantity of pollen to ensure it falls on its wide-spread targets. In areas where these types of plants predominate, many people suffer from hay fever, an allergic reaction to all that wind-blown pollen.

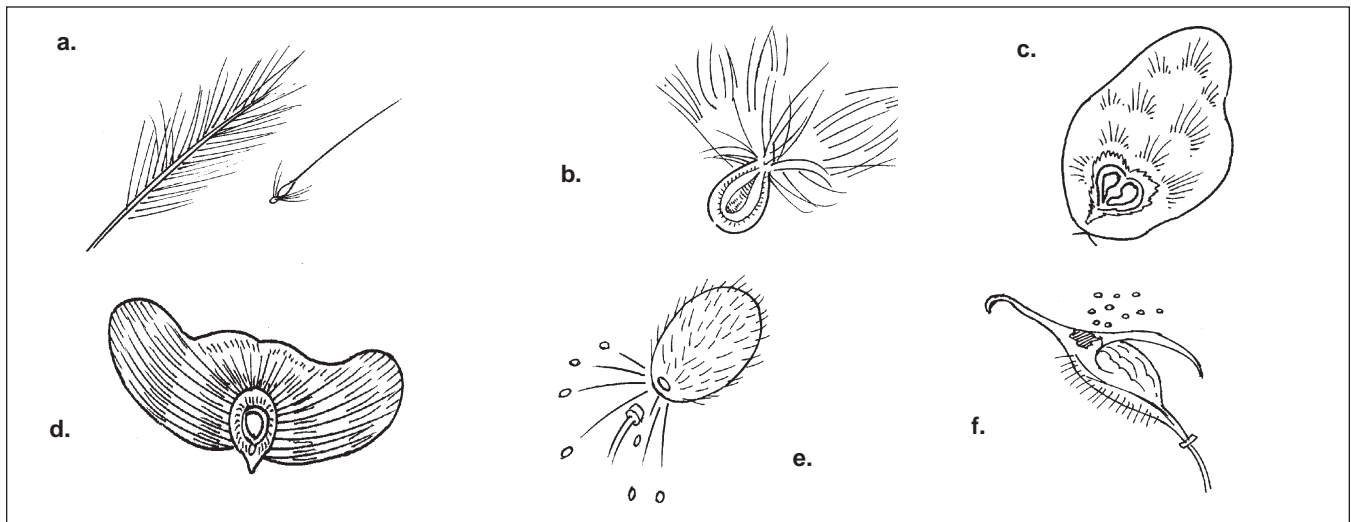


Fig. 6. Wind Borne Seeds. a. Grass; b. Dandelion; c. Tulip tree; d. Sycamore; e. Impatiency; f. Unicorn plant.

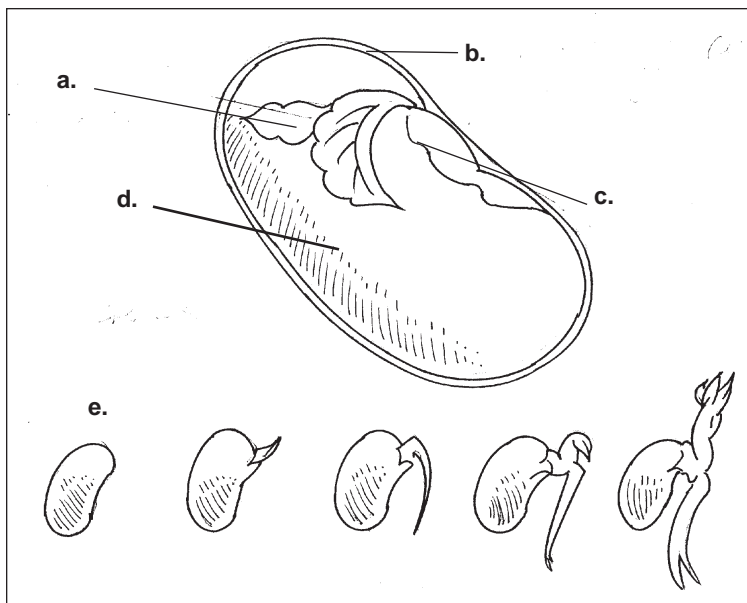
## GERMINATION AND ESTABLISHMENT

Once the seed germinates it is dependent on specific environmental conditions that favor its establishment. Some plants require shade and ample moisture to develop while others need full sunlight and occasional deep watering. Soil drainage and fertility, pH, humidity and temperature are also factors that differentiate habitat for different plant species, and will favor one plant over another should they occupy the same growing space.

In general terms, fast growing sun-loving plants will out-compete shade plants for nutrients and water in an area exposed to sun. Eventually, as these plants mature and the ground receives more cover, plants less sensitive to shade will establish seedlings and eventually emerge more dominant as the faster growing plants die out. Only

a disturbance event that eradicates the shade cover will provide conditions for the sun plant to re-generate and the pattern of succession to resume. Sun plants that root in less exposed areas tend to flower less and become leggy as they search for light. While shade plants tend to wilt or burn in hot and highly exposed areas. Plants that undergo any type of environmental stress become more susceptible to pest infestations, pathogens or disease.

Understanding the growth requirements of plants, the conditions that allow them to flourish, and making the decisions of what and where to plant brings inmates closer to decision making processes that can help them make better choices for their own lives. What are some of your students' needs that will make their lives more productive?



**Fig. 9. Parts of the bean plant. a. First leaf; b. Seed coat; c. Radicle (embryonic root) d. Cotyledon; e. stages of germination.**

### Exercise 3 Seed Dissection

Source: Monica Hannaman, Horticultural Society of New York Apple Seed Program

#### Materials:

- \* Lima Beans soaked for 24 Hours
- \* Toothpick
- \* Parts of a seed handout (See Illustration above)
- \* Magnifying Glass

#### Procedure:

- \* carefully split the bean
- \* Using a toothpick, separate the parts of the seed
- \* Identify the parts of the seed by comparing them to the handout
- \* Create your own chart using the actual seed parts, or carefully draw or paint them into a notebook

## **Exercise 4**

### **The right plant for the right place**

#### **Materials:**

- \* Notebook
- \* Outdoor Plant Guide (DK's "Good Plant Book" is a good example)
- \* Seed Catalog
- \* Zone Chart

#### **Procedure:**

- \* Tour the site of prospective garden installations
- \* Note down such features as hours of sunlight, existing plants and trees and availability of water sources other than rain
- \* Refer to a zone chart to identify your geographical zone
- \* Research appropriate plants for the site. Use source books to create an ideal plant list. Also consider transplants of existing plants which have adapted well to your compound and seed catalogs for new plantings.

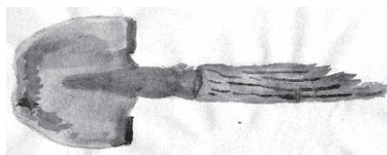
Using plants for site considerations. Students are given different site conditions on index cards and asked to create plant lists appropriate for the site.



# Chapter 3: Soil and Fertility

Soil is Civilization

- Wes Jackson



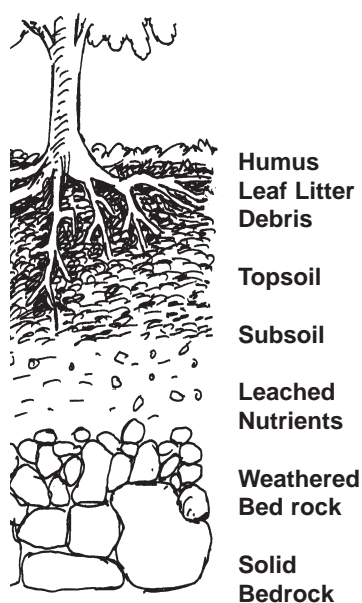
*“Soil is a complex system consisting of air, water, inorganic matter (fine rock particles), and organic components such as decomposed or decaying plant and animal matter and soil animals including earthworms, insects, fungi and bacteria.”*

Soil is the literal foundation of any garden system, and its quality and type will ultimately determine the kinds of plants it best supports. Soil determines which nutrients are accessible to plants as food, the quality of drainage and moisture retention, the chemical balance that certain plants depend on, and provides a substrate for healthy plant roots to spread and grow. Despite this importance, soil is a resource that humans have squandered over the past two millennia. Many areas in the world that seem like deserts were once fertile regions supporting civilizations that today no longer exist. As valuable topsoil continues to erode and disappear, so does our capacity to grow food that supports our existence.

But what is soil? Soil is a complex system consisting of air, water, inorganic matter (fine rock particles), and organic components such as decomposed or decaying plant and animal matter and soil animals including earthworms, insects, fungi and bacteria. A typical garden soil contains 50% solid, 25% liquid, 25% and 25% air and should be friable -light and crumbly. Healthy soil is alive; the more organic activity there is in a handful of soil, the more nutrients there are to support and keep plants healthy.

Soil is arranged in three main layers called horizons—topsoil, subsoil and parent rock. Topsoil is the top layer that contains organic matter, decayed plant and animal waste (litter or duff), mixed with a little inorganic (rock particles) matter. This 2 to 6 inch layer is where most of the organic activity takes place, and has the greater concentration of nitrogen-based nutrients. Subsoil is lighter in color than the topsoil and has a greater concentration of minerals. Organic matter which generally leaches down with rainfall as well as decayed plant roots furnish the rich organic mix.

Finally, the underlying parent rock provides the mineral particles found in the subsoil through a process called weathering. In areas affected by glaciers, including much of the northern United States and Canada, till rocks carried down and pulverized by moving sheets of ice created much of the parent material found in the region's subsoil and often different than the underlying substrate rock. Generally, soil formation is a slow process, taking over 100 years to produce one inch of topsoil.





**Fig. 1.**

**A worm's eye view:**

**Abundant earthworms, millipedes and other soil organisms.**

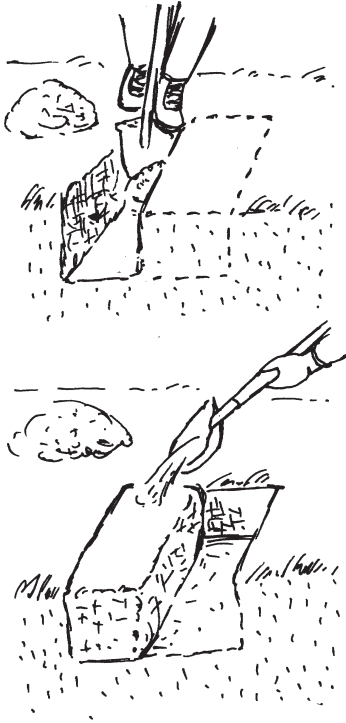
**Plants and organic mulch cover soil surface.**

**Dark topsoil layer at least 6 inches deep.**

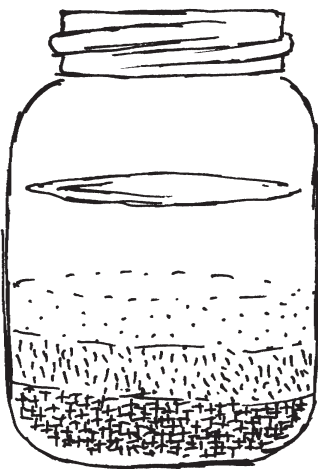
**Healthy roots with plenty of root hairs.**

There are many clues both above and below ground level about the health of your soil: soil color, humus content, presence of living organisms and drainage. The land fill soil that predominates on Rikers Island is grey in color due to high concentrations of building materials. This indicates poor aeration with poor drainage. After introducing compost and mulch to the soil, the amount of organisms living within the soil increased and the color is gradually mellowing towards a dark brown that is indicative of better drainage.

Soil is classified according to the size of the particles. Clay is the smallest (smaller than .0002 mm) followed by silt (.0002 to .02), and sand (.02 to 2mm). Despite its size, clay is the heaviest of all soil types, compacts easily when dry and becomes extremely sticky when wet. The microscopic particles in clay tend, to compress tightly together, making it difficult for plant roots, oxygen and air to pass through freely. Clays heat and cool off slowly and drain poorly, but because they cling tightly to nutrients are generally quite fertile.



**Fig. 2. Double Digging.** Soak the soil with water a few days before, remove weeds and sod. With a spade dig an area 1' wide by 1' deep. Sepsit the soil into a wheel barrow. Dig a trench alongside and deposit the soil you have just dug. It's back-breaking work but keep at it till you have dug the entire area in this way.



**Fig. 3. The relative proportions of sand, silt and clay in the soil is referred to as soil texture.**

Sand contains large pore spaces between the particles, allowing water to drain easily and nutrients to wash or leach out. Air in the pores heats up and cools off rapidly making sandy soils good to plant in for the spring but bad for the fall. Roots grow easily in sandy soil and make an excellent medium for propagation and for establishing new seedlings.

Light rains do not penetrate silt well but tend to run off. Once the soil is wet, however, it holds water and nutrients in a much better condition than sand.

Most gardens are planted in a soil that is a mixture of clay, sand and silt. Soil containing roughly equal amounts of each is called loam. Many plants can thrive in soil containing 30 to 50 percent silt, 30 to 50 percent sand, and 20 to 30 percent clay. Usually a rich brown color, it retains moisture yet drains quickly enough to prevent roots from becoming water-logged; it is well aerated and allows roots to penetrate easily. Loam not only retains nutrients which cling to the smaller clay particles, but also makes them more available for plants. Loam with a higher percentage of sand is called sandy loam, while that with a higher percentage of clay is clay loam. These are important distinctions when it comes to amending the soil and knowing how to best take advantage of your planting conditions.

Even good loam soil needs an enrichment of compost or humus to maintain its fertility, especially when growing annual crops of vegetables and flowers. Humus is the dark, sticky decomposed plant and animal matter one finds on the topsoil layer of the forest floor. Compost is in a stage of decay where it is still possible to identify pieces of litter such as twigs or rotting bark and leaf mold. Both provide valuable nutrients and animal activity to the soil mix while creating texture that retains moisture in sandy loam soil and better drainage and aeration in clay loam types.

### **Exercise 1**

#### **Measuring Soil Component Proportions**

##### **Materials:**

- \* 1 quart jar with straight sides and a tight lid
- \* 2 cups of soil

##### **Procedure:**

- \* Place 2 cups of each of the soil you collected into a jar. Add water until the level is about one inch above the soil. Cover tightly.
- \* Shake well and wait 24 hours.
- \* Measure the height of each layer.
- \* Divide each by total height of water in jar.
- \* Multiply each by 100 to calculate percentage of sand, silt and clay.

## Interpreting your results

### Soil Profile

### Ammendment

#### Sandy

Topsoil: If your soil is sandy topsoil may help it to retain moisture better. Topsoil is available from commercial garden centers.

#### High Amount of Clay

Sand: Soil with a high amount of clay in it benefits from sand. When you add sand also be sure to add organic matter.

#### Lots of Sand or Clay

Spagnum Peat Moss: Will improve the texture of soil that has too much sand or clay. It is sold in bales or bags. It has no nutrients but it composts over time.

#### Average Soil

Humus: Is organic matter that will improve the texture of almost any soil. It lightens up dense clay infused soil, and plugs up the holes in sandy soil. It is available from garden centers.

## Nutrients: Food for Thought

We often think of plant food as the carbohydrates produced by plants through photosynthesis. But apart from the carbohydrates produced by sunlight, plants also need 16 different nutrients to grow, 13 of which are derived from soil. The other three – oxygen, hydrogen and carbon – are found in water and air. Macronutrients, the nutrients plants use in the greatest amounts, are nitrogen (N), phosphorous (P) and potassium (K). When these three nutrients are available to plants in waters soluble form, soil is considered to be relatively fertile or “complete.”

**Nitrogen** is essential for leaf and stem growth resulting in lush green plants. Most nitrogen is obtained from decomposed plant matter or manure. Leguminous plants such as peas and beans, or clover are able to convert nitrogen as a gas into nutrients through bacteria at their root nodes. These nitrogen-fixing plants make a good live or “green” manure that can be planted and then tilled into the soil. Nitrogen-deficient plants often have leaves where yellow starts at the tip and progresses towards the stem. Spindly, stunted growth, dying stems or branches are also telltale signs.

**Phosphorous** helps develop strong roots and colorful flowers, promotes winter hardiness, resistance to disease and increases the vitamin content of fruit and vegetables. Poorly developed sees and leaves that are purplish or poorly developed are often a result of phosphorous deficiency.

**Potassium** promotes cell division and growth and helps the plant metabolize other nutrients, especially nitrogen. It also aids in the production of starches, oils and sugars for fruit, increases tolerance to drought and encourages resistance to winter cold and disease. Sterile seeds and leaves that often turn crisp at the edges, then brown are often in need of potassium.

Secondary or micronutrients consisting of calcium, sulfur and magnesium

## Summary of mineral elements needed by plants

### Macronutrients

Element	% of dry weight
Nitrogen	1 – 4%
Potassium	0.5 – 6%
Calcium	0.2 – 3.5%
Phosphorus	0.1 – 0.8%
Magnesium	0.1 – 0.8%
Sulfur	0.05 – 1%



## Natural Fertilizers

Besides the fact that most programs are strapped for funds much of the time there is another reason for going to the trouble of mixing your own general purpose organic fertilizer. Your students will realize that it is not necessary to rely on commercial preparations and they will also learn more about the nature of fertilizer by studying the component parts.

Use one from each category mixed with one amendment from the other two categories in the proportions shown (its also a good way to promote math literacy). For example:

### Nitrogen (N)

2 parts blood meal  
3 parts fish meal

### Phosphorus(P)

3 parts bonemeal  
6 parts rock phosphate or colloidal phosphate

### Potassium (K)

1 part kelp  
6 parts greensand

are used by plants in smaller quantities and are generally available to the plant. Calcium helps with tissue formation in the plant's meristems by aiding in the synthesis of pectin – the “glue” bonding cell walls. Both sulfur and calcium help change the chemical nature of soil by raising and lowering the level of pH (see under pH). Trace nutrients including copper, zinc, iron, boron, molybdenum and chlorine all play a role in activating enzymes, which aid in the metabolism of cell division and plant growth.

## Fertilizer and Soil Amendments

In most natural systems dominated by plant communities, nutrients return to the soil when plant leaves, stems and roots die and decompose. This continuous release of vital nutrients is generally slow enough to prevent excessive uptake by plants and helps prevent nutrients from leaching out as subterranean run-off from heavy rains. Replicating this system with a layer of mulch and compost is often the most beneficial method of improving the soil, adding nutrients and texture as well as promoting local conditions for soil micro-fauna. Other natural amendments or additives include bonemeal, bloodmeal, wood ash, eggshells, limestone and gypsum (see natural fertilizers).

Earthworms are always a good indication of healthy and productive soil. Earthworms transform decaying leaves and roots into nutrient rich castings; their journey through the substrate aerates the soil and brings mineral particles from below to mix with organic matter on top. A square meter of garden soil may contain as much as 2 pounds of live worms and their constant activity is instrumental in creating productive, fertile soil.

Today, with so many natural amendments available in the market place, there are mostly disadvantages to using synthetic or chemical fertilizers. Chemical fertilizers are mobile and can readily leach out into nearby water bodies, generating conditions that are often harmful to aquatic systems. High applications of fertilizer can “burn” plant roots, or if they are heavy in nitrogen like many grass fertilizers, they can produce excessive growth in flowering plants at the expense of fruit and flower production. Chemical fertilizers are simply quick injections of nutrients that, on their own, do not sustain good soil conditions over time. Conversely, fertilizing soil without amending it will eventually reduce the soil's fertility—decreasing the quality of its texture, and depleting the microorganisms good soil depends on.

Whether synthetic or natural, store bought fertilizers list the percentage of nitrogen, phosphorous and potassium present as a ratio. This helps the gardener apply the most beneficial amount required by plant types. For example, a general fertilizer for perennials or flowering shrubs may contain a NPK ratio of 20-20-20. A fertilizer for bulbs is typically 0-20-10, since the plant's energy is focused on root and flower development and not leaf formation. Grass, on the other hand, will contain mostly nitrogen at 30-0-10.



## Soil pH Demystified

Knowing the pH of your garden soil – whether it is alkaline or acidic —is instrumental to knowing how well plants will grow in their designated garden space. acid soil can tie up phosphorous, while alkaline soil immobilizes iron, boron, copper, manganese and zinc. The explanation is relatively simple: on each soil ped (particle) there are negative and positive chemical charges. Since hydrogen is positively charged, excess hydrogen, will attract negatively charged ions including sulfur and phosphorous. These ions with their total negative charges create soil conditions that have an acidic pH. Alkaline soil contains negatively charged hydrous oxides which attract positively charged ions such as calcium, copper, iron, and boron.

The pH scale ranges from 1 to 14, with neutral at 7, acid below neutral, and alkaline above. Any movement from one number to the next is an exponential increase in the level of acidity or alkalinity of the soil. For example, a soil with a pH of 5.5 is ten times more acidic than a soil with a 6.5 pH and a hundred times more acidic than a soil with a pH of 7.5.

Most plants, especially garden variety vegetables thrive in a pH slightly acidic to neutral. However, for shrubs, trees and perennials, their native environment will predictably dictate the type of soil they grow best in. Plants from wet environments generally do best in acid soil (bogs have extremely acid soil conditions). Rhododendrons, azaleas, blueberries and heather are a few examples of acid loving plants. And plants native to drier systems prefer more alkaline conditions. Cacti, for example, need a high pH that is typically found in desert systems. Adding amendments such as limestone ( which has positively charged calcium ions that displace the hydrogen ions) can balance acidic conditions, just as adding sulfur based ions can acidify a high base or alkaline soil.

## Rikers and its Compost

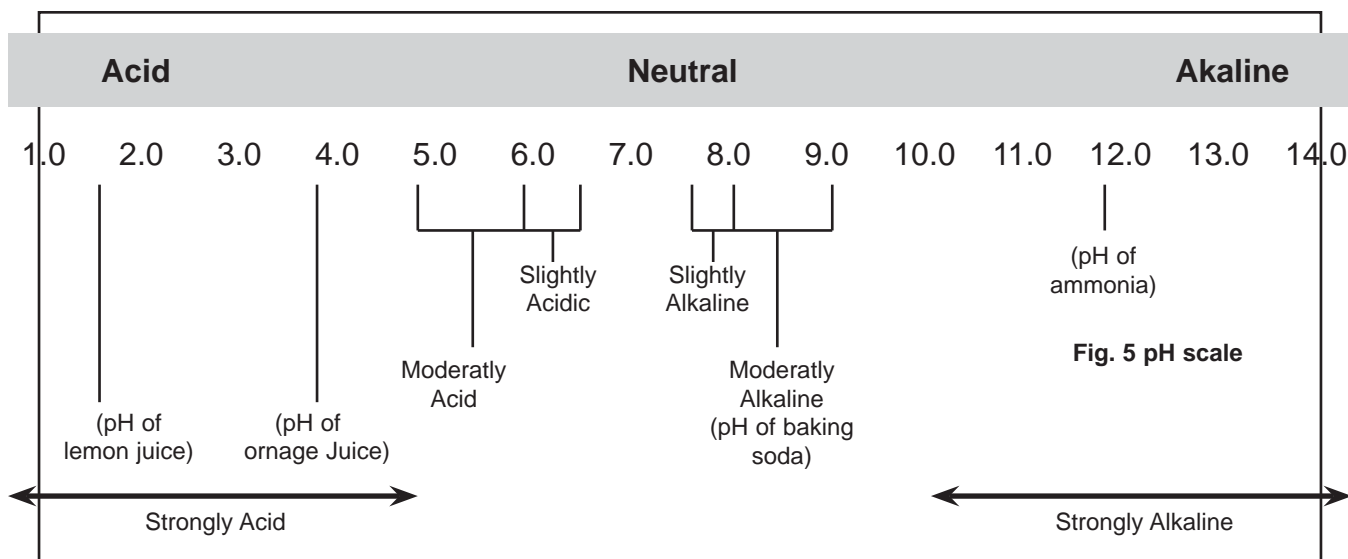
When inmates at the ten jails on Rikers Island neglect to clean their plates of food at mealtime, the residue is accumulated in giant bins and composted on a state-of-the-art composting facility on the island. That means 60,000 meals a day are converted into rich organic compost in little less than 6 months from leaving the kitchen. Built by the Department of Sanitation to offset the impending closure of NYC's Freshkill landfill in Staten Island, the facility cost 5 million dollars, mostly from state money, and is located on an isolated corner of the island.

Food from leftover meals is mixed with wood chips into a yeasty substance that smells like manure. A huge conveyer heated by solar panels carries the mixture through the building, then after six weeks it is loaded onto trucks and stored on unused fields behind a prison building. The final result is a non-odorous, high-grade fertilizer that is used in the Rikers farm and gardens, or shipped out to the Parks Department to be used in city parks.

"It's the largest composting facility in America used strictly for food waste," said Robert LaValva, the Sanitation's Department chief of composting. "This is the point of reference for the rest of the city."



Fig. 5. Here we are adding compost to the soil.



### Exercise 2:

#### Measuring soil pH

#### Materials:

- \* 1 quart jar or small pail
- \* trowels

#### Procedure:

- \* Select the site to be tested.
- \* Choose six different areas of the garden.
- \* Combine the soil samples into one container and mix well.
- \* Use a commercially available pH testing kit to determine the levels of acidity or alkalinity.
- \* Refer to the table on this page to create a strategy for raising or lowering the pH of your soil.

A soil testing kit that can measure both pH and nutrient contents is an excellent way to familiarize students with the chemical and biological activity of their prospective garden soil. Amendments that generate good soil structure as well as conditions that support a healthy population of earthworm and micro-biota activities will buffer narrow swings in soil pH and produce healthy plants year after year.

### Raising and Lowering pH Exercise

Soil is dynamic matter, a strange blend between animal activity, mineral weathering and organic decay, that is instrumental in sustaining life on Earth. With only six inches of fertility, a thin mantle of mixed organic crust covering the planet's surface. Soil has been severely damaged by poor land use practices throughout the world. Replenishing this resource begins in the garden, for it is here we can experience its benefits as we learn to be stewards of our own garden system.

#### Raising or Lowering pH

Material	Soil type	Starting pH	pH after change	lbs per 100 sp. ft.
Limestone	Sandy loam	6.0	6.5	5
Limestone	Sandy loam	5.6	6.5	8
Limestone	Silty loam	6.0	6.5	10
Limestone	Silty loam	5.6	6.5	15

Try using elemental sulfur to correct alkaline soil. As in the case of acidic soil there are no hard and fast rules. Add a little at a time and never more than once per year. Test often and carefully.

### **N.C. Department of Correction finds ways to save the environment as well as tax dollars**

Gov. Hunt charged Assistant Secretary Lynn Phillips with the task of being the sustainability officer for the Department of Correction. Phillips named Randy Lee of Correction Enterprises as sustainability coordinator for the department.

"While the department has made a concerted effort to improve its efficiency, with recycling and waste reduction being one of the strategies, sustainability is a more comprehensive agenda targeting, specifically, the protection of our environment," Phillips said.

Environmental sustainability may sound like a complicated term, but the department has some easy examples of what sustainability is all about:

- \* Caledonia Correctional Institution's composting project turned thousands of pounds of kitchen waste into potting soil and fertilizer for its greenhouses.
- \* Brown Creek Correctional Institution reduced its waste by 60 percent by composting food, shredded paper, dryer lint and hair from the barber shop. The prison also switched from using half-pint milk cartons to a bulk dispenser and replaced five-gallon detergent containers with 55-gallon reusable drums. Inmates recycle other waste, and employees bring their own coffee mugs to work instead of using Styrofoam cups.
- \* In 1996, Correction Enterprises' paint plant located at Johnston Correctional Center received recognition in the Governor's Award for Excellence for reducing the number of steel drums used at the paint plant by using plastic liners instead of scrubbing out the barrels after each use. Drums are now reused 60 times instead of six and have saved the state \$325,000 per year.
- \* Southern Correctional Institution prisoners are turning donated scrap cloth into blankets for emergency shelters and schools.
- \* Caswell Correctional Center inmates are now repairing pneumatic and electric hand tools that used to be discarded when they stopped working.
- \* When done properly, prison landscaping protects the environment by reducing the amount of maintenance required.
- \* About 200 million pieces of paper will be saved each year when Correction Enterprises' duplicating plant begins sending print jobs digitally to state agencies, saving trees, money, time and waste. Last year, the department saved \$7 million in printing costs.
- \* New Hanover Correctional Center inmates separate organic from inorganic material at the local landfill.

Phillips sees these sustainability efforts creating more jobs for inmates, thus closing the loop on Gov. Hunt's first request to put every able-bodied inmate to work. "We're open to any idea that will make sense in this state to help with the environment," Phillips said.

The department intends to build upon its current network of recycling coordinators and develop an agency-wide management structure for sustainability. This organizational initiative will seek the commitment of all employees to be innovative and provide a system of communicating strategies that improve sustainability.

# Chapter 4: Building the Garden

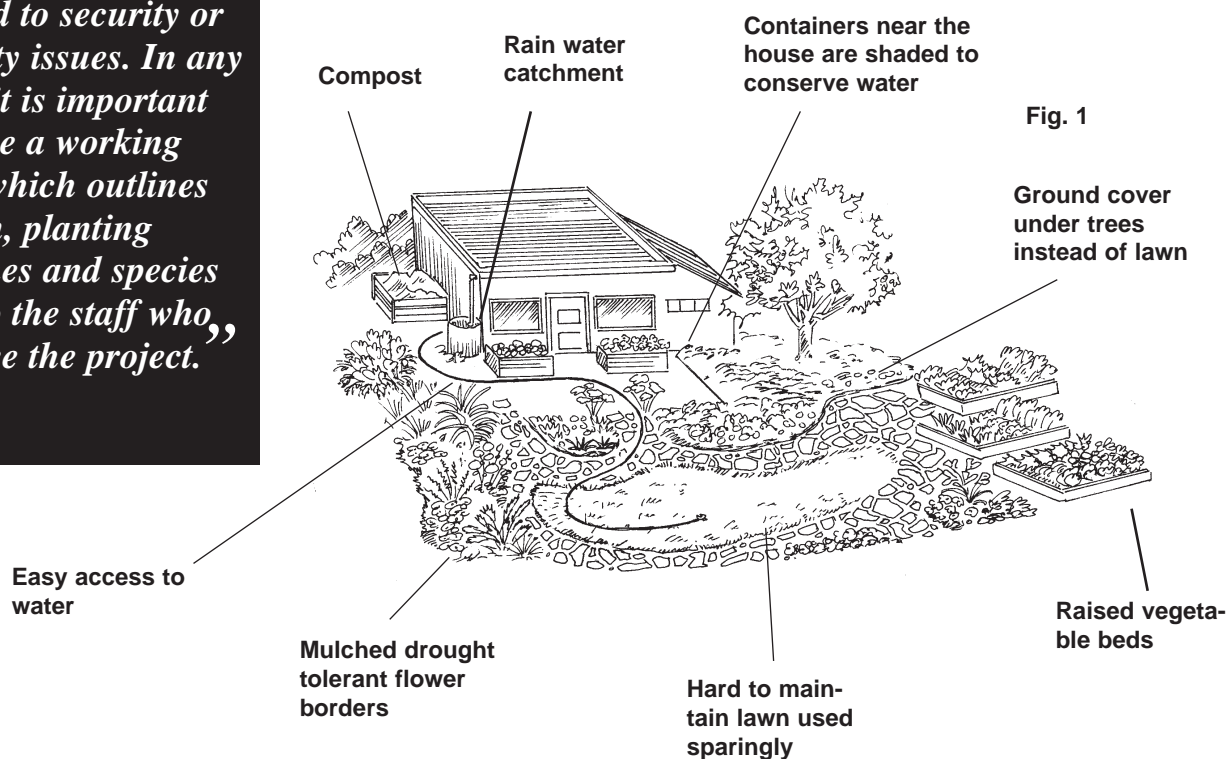
*St. Stephen with a rose, in and out of the garden he goes . . .  
— The Grateful Dead*



***“Each facility will have its own set of regulations regarding the type and scale of gardens permitted in the prison. These are sometimes arbitrary decisions based on the likes and dislikes of an administrative official or are directly related to security or liability issues. In any case, it is important to have a working plan which outlines design, planting schemes and species mix to the staff who, oversee the project.”***

The creation of vegetable gardens, orchards, perennial walkways, herb and rose gardens, ponds, restored native systems, memorial gardens and massive plantings are a striking array of gardening projects that can help inmates develop an understanding of technique and design in the limitless field of gardening and horticulture.

Each facility will have its own set of regulations regarding the type and scale of gardens permitted in the prison. These are sometimes arbitrary decisions based on the likes and dislikes of an administrative official or are directly related to security or liability issues. In any case, it is important to have a working plan which outlines design, planting schemes and species mix to the staff who oversee the project. (Once in designing public gardens on the median strip on Rikers Island, the Warden in charge told me I could plant anything but flowers. Later when the Warden was transferred and replaced by someone else, we began to plant a mix of bulbs, annuals and perennials and applauded for our efforts).



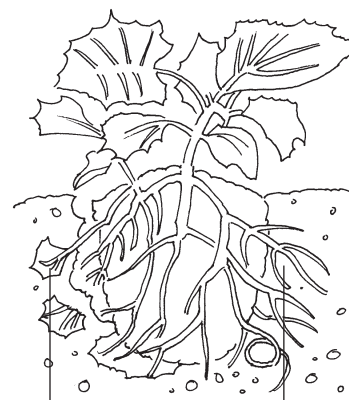
### **A Note about Planting: Death to Air Pockets**

Experience has demonstrated that the greatest risk of mortality for newly planted perennials and shrubs are poorly planted plants. Many occasions have I seen a dead or wilted plant and watched my hand disappear easily between the root ball and newly dug hole.

**Rule #1:** Make sure the soil is firmly packed between the root zone and the hole. Air pockets prevent the roots from making contact with the soil, which draw water through the soil in a capillary fashion. Without that contact the roots virtually dry up, killing the plant if there are too many pockets in the soil. Students should use their hands to firmly press the soil into the hole as opposed to just moving soil into the hole with a trowel or shovel.

For heavy clay soils, avoid walking around the newly planted hole to avoid compacting the soil and preventing water and oxygen from penetrating the surface layers.

**Rule #2:** Always remember to water after planting giving the soil – not the plant – a good drenching for the roots.



**Incorrectly  
planted,  
note air  
spaces.**

**Correctly  
planted, soil  
is firmly  
packed  
around  
roots.**

**Fig. 2**

In an informal survey of different prisons it was found that a large percentage of programs simply focused on the landscape and maintenance of prison grounds. A few programs have working greenhouses which are used for commercial plant production, or for raising annuals that are planted around the prison. Other facilities simply have large vegetable gardens that are used to produce food for the inmates' consumption.

### **Exercise 1**

#### **Create a bird's eye map of your site**

##### **Materials:**

- \* 1/4 inch graph paper
- \* Pencils and erasers

##### **Method:**

- \* Draw a rough sketch of your site on graph paper.
- \* Represent existing plants with organic shapes.
- \* Squares and rectangles represent structures.
- \* Walk the site as you draw it. Pace off the distance between plants and buildings so you can represent them more accurately.
- \* Save your map as you learn more about the needs of different plants, the resources at your site and the practices of good design you can use your imagination to sketch in possible gardens. Work on overlay or have a good eraser so you can be free to make changes.



## Chapter 5: The Vegetable Garden

*“It is not a long stretch to proclaim that the process of growing food has all the elements of a dynamic therapeutic program.”*

Vegetable gardens are a wonderful and important introduction to horticulture and gardening. The benefits are generally obvious. When inmates of the horticulture program on Rikers Island were asked how they felt about growing and eating produce from their 40 by 20 foot garden at Rikers, they mentioned self-sufficiency, knowledge, wonderment, a connection to the earth, pride, satisfaction and a feeling of importance. The students also expressed a feeling of safety in knowing where the food they ate came from.

It is not a long stretch to proclaim that the process of growing food has all the elements of a dynamic therapeutic program. The metaphors are endless in the rituals of preparing soil, sowing seeds, the transplanting of seedlings, thinning and weeding, fertilizing and watering, and of course, the eventual harvest.

### SITE SELECTION BASICS

Balancing your hopes and wishes against local conditions is an important life lesson taught every day by the gardens. Participants to your program will come to realize that somewhere on their compound are perfect spots for vegetable gardening. Identifying that spot is an exercise in evaluating needs and measuring them against resources and commitment – a process that is at the core of productivity. The best way to identify these sites is to understand the needs of plants.

#### Light

Six hours of light may be enough in warm climates. A full day, however will be needed in cooler areas. Locate your garden on the south side of a structure. Shady spots are good for compost heaps.

#### Drainage

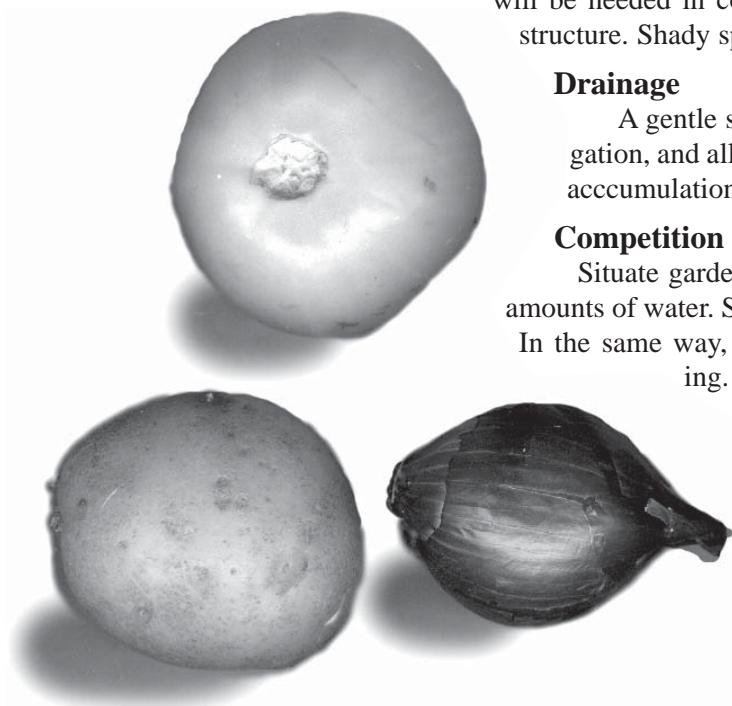
A gentle slope will allow your garden to absorb rain water or irrigation, and allow excess water to run off. Avoid low lying areas. Water accumulation creates a situation favorable to disease.

#### Competition

Situate gardens well away from big trees as their roots take up huge amounts of water. Small fruit trees are good neighbors to vegetable gardens. In the same way, nurture beneficial relationships with companion planting.

#### Water

Consider water availability. No matter where you live you will need to do additional watering during dry spells. When gardens are placed out of range of a hose you will be forced to rely on hand watering. While hand watering is a good way to get to know your plants close up and is both soothing and productive, the time inmates



may be able to tend to this chore may be just too limited to allow for a good job. Give your gardeners every chance for success.

## LAYOUT

Arrange beds so that the large amounts of mulch, manure, and mineral fertilizers are easy to access. Rectangles and squares are easiest to lay out. Curved shaped beds can accomodate structures and benches. If you are planting on a slope you might find it is most natural to follow the curve of the landscape.

## Row Planting

If you have a big site you may want to use row plantings. Though not as efficient as beds or spot gardens they are easy to organize and plant. Your gardeners probably won't get the yields out of their rows that they might from raised beds, but the work of planting is efficient and quick for large areas of plants like beans and corn. A border of herbs and flowers will enhance the appearance and invite helpful insects.

## Beds

Beds allow for more intensive gardening. The soil is easily enriched, and there will be less weeding. They require more time to prepare but they won't need as much weeding and mulching later on. Your yields will be greater because the amount you can grow in the raised bed per square foot is greater than rows. And in urban areas where the soil may be landfill you have to use raised beds. Try and keep them down to about 4 feet in diameter so you can easily reach all parts of the bed. In the section on planting there is more information about adapting raised beds to special needs.

## Spot Gardens

If your site is small or if you are working your vegetables into an existing garden you may want to consider spot gardening. Spot gardening appeals to me because it seems to suggest that a real vegetable garden can exist in the most unlikely spot. All you need is consistent sunlight for about eight hours. Fit small plantings of your stu-

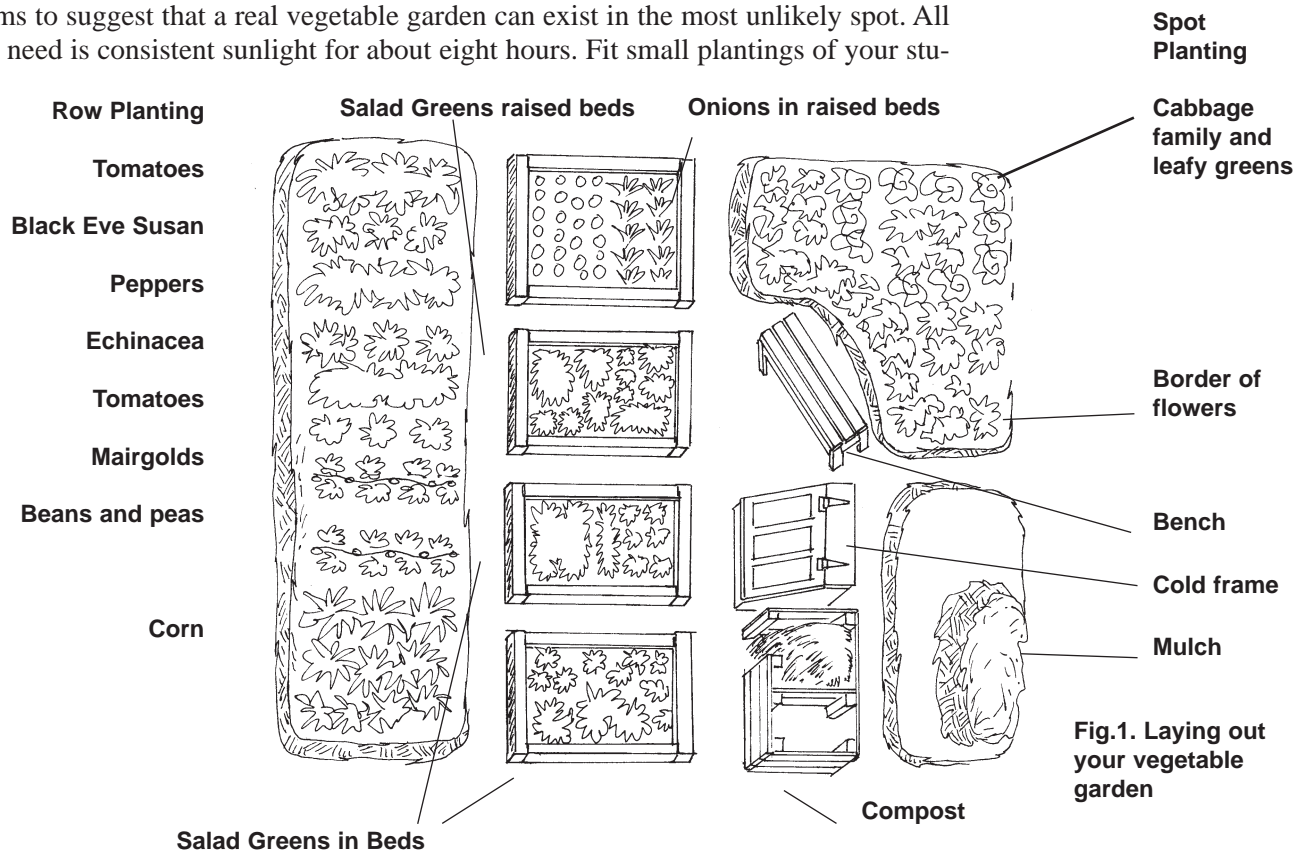
## Exercise 1 Locating your vegetable garden

### Materials:

- \* Site map from Exercise 1
- \* Site selection basics information

### Procedure:

Using the site map created in Exercise 1 and the site selection basics information locate you vegetable garden in the most appropriate place.



dents favorite crops into these sunny spots. You can create companion plantings by underplanting climbing tall crops like tomatoes with marigolds.

### **But how to go about it? Where to Start?**

Certain programs enforce the idea and advantage of communal work in facilities where inmates have short sentences and may not spend an entire plant-to-harvest season in the prison garden. The idea of a common bed reinforces the spirit of shared responsibilities and common goals in the workplace. The motivation is simply being part of a process as opposed to actually reaping the rewards of a productive harvest.

On the other hand, it is also beneficial to give inmates shared or individual plots that allow them to make their own decisions as a statement of self or cultural expression and creativity and demonstrate both individual and shared responsibility for watering and weeding.

Inmates with long-term sentences may be better off with individual plots. The continuity of gardening, the student's ability to learn through years of experimentation, trial and error and a compilation of what works is a process of incalculable value.

#### **The Massachusetts Story North Central Correctional Institute**

The Gardener Correctional Institute in Gardener Massachusetts has a long-running program that allows teams of five or six inmate gardeners to tend individual garden plots. In a facility where inmates may be incarcerated for long-term sentences, obtaining a garden plot is a special privilege. A large number of Gardener inmates are serving life and double-life sentences, while 50 - 60% of the population are incarcerated for sex offences.

It's easy to see why individual plots are so valuable to inmates. They are allowed to keep or barter any produce they harvest. The most experienced gardeners adopt a leadership position, handing out weeding and watering duties to other inmates. As the harvest draws near, newer members are assigned to guard plots. The year after year cultivation of their vegetable beds provides a stable framework for inmates serving long-term sentences. Vacancies are available only when inmates are released or transferred.

The garden plots supplement the prison fare with fresh produce. The gardeners compete with each other to see who can grow the best tasting or largest vegetables. The gardens promote self-reliance within a setting of cooperation as expertise is passed from one generation of inmates to the next — not unlike the workings of a small family farm.

Many offenders who never voted, held a position of responsibility or even expressed an opinion on any community matters find themselves practicing a form of democracy based on "private property" and shared responsibility. Prisoners are able to pool resources while each is free to use his share any way he chooses. Some prefer to directly consume their produce, while others use it to purchase services and goods from other inmates in a kind of micro-economy. These garden plots become mechanisms for problem solving, models for rehabilitation programs, opportunities to teach management concepts, tools to illustrate the importance of planned rather than impulsive behavior, and channels for inmates to translate their personal experiences into a community effort.

For more information, contact Greg Barnett

## Exercise 2

**Identify vegetables that may be appropriate to your area. This exercise can be done any season.**

### Materials:

- \* Zone map
- \* catalogs, and gardening books
- \* note book
- \* the site map

### Procedure:

- \* 1. Look for heirloom varieties that are found in your climate zone of each:
  - tomatoes
  - peppers
  - potatoes
  - leafy greens
  - salad greens
  - annuals & perennials (companion plants)
- 2. Note down their names in your notebook.

Vegetable gardens can be culturally thematic, with sections cordoned off for plant foods from different regions from around the world. Caribbean plant foods can reside near a plot for African foods, or herbs from Southern Europe. The number of ideas which bring students closer to geography, the difference of plant biomes and human culture are limited only by one's own imagination. At Rikers, the instructors devoted a small section of space in the garden to growing the "three sisters," a Native American companion planting scheme involving squash, beans and corn.

The positioning of beds can be as creative or pragmatic as space allows. Generally, raised beds seem to work best for it demonstrates the demarcation between well tended soil, and public garden footpaths. Sandy soil, which generally is not suitable for raised beds, should be well amended with compost and manure. Over time, the beds will benefit from a continuous source of organic amendments, not only increasing the available nutrients in the soil but also improving the soil's texture and its capacity to retain moisture.

## Garden Curriculum

A science and horticulture curriculum can be based entirely on a small annual vegetable garden. The following is one example of an integrated science education, life skill and vocational work curriculum:

### Soil Preparation:

What is good soil? What is pH?  
How to test your Soil.

### Composting:

Decomposition and nutrient recycling.

### Seed germination:

Reproduction and plant growth  
Plant growth (photosynthesis and transpiration)

### Thinning:

Competition and ecology

### Weeding:

Invasive plants and their control

### Watering:

Evapotranspiration and the water cycle

### Pests:

Natural control (IPM). Predator-prey relationships in the garden

### Harvest:

Plant reproduction and fruit production

### Recipes:

Nutrition and its effect on health

### **“Three Sisters” Curriculum**

The Three Sisters is a Native American planting scheme that integrates beans, squash and corn in a mutually dependent gardening system. It works like this:

The bean plants wrap their way around the corn using the sturdy corn stalks as support. The bean plant provides the corn with nitrogen for the next growing season when the spent leaves are mulched into the soil. The squash vine wraps around the base of the corn creating a dense mat that represses competing weeds. The vine also creates a humid micro-climate which helps retain moisture at the soil surface while the tough spines help repel hungry predators like raccoons.

The importance of this elegant system was not lost on the Iroquois Indians who made three sisters a part of their tribe’s creation story and used the crops as a dietary and nutritious food staple.

Instructors can use this system as a lesson plan that introduces concepts such as nitrogen recycling, mutually beneficial plant interactions, micro-climate, plant architecture and ethnobotany. It also demonstrates ways to maximize crop production in a low maintenance, energy-efficient system that is sensitive to the surrounding environment.

It should be noted that certain varieties of corn, squash and beans are more suited for this system than others. Runner beans either vine or pole varieties are needed to climb the corn, while the corn needs to be a sturdy type that can bear the weight of heavily laden bean vines. The squash must be a variety that forms a dense ground cover to serve its purpose as a living mulch.



In general, we encourage diversity and randomness in the vegetable garden in the same way we look towards diversity in the “natural garden.” For example, a small plot consisting of tomatoes inter-cropped with marigolds, lettuce, beans and basil ensure a colorful, fragrant, early-to-late summer harvest with a built-in insect control system. Students should be encouraged to seek their own combinations for systems that are productive, have long-lasting harvests and equally, are aesthetically fitting for public spaces.

Finally, planting a mix of annuals and perennials that have edible flowers is a great way to supplement the food source with taste, nutrition and an aesthetic garnish. Nasturtiums, Johnny-jump-ups, violet, and pansies are flowers that provide nutritious texture to a summer salad.



## LAST NOTE ABOUT FOOD

\* If your facility has a food prep program find out what type of herbs or vegetables would best serve their needs.

\* If you anticipate excess have a source ready to send it to.

\* Send produce to the kitchen, or arrange to have students either cook their own food or have the facility's kitchen prepare food to take to the site for lunch.

### Seeds and space required for popular vegetables

Fresh meals for 100 people	
Crop	Seeds/Space
Bush Beans	3-5 lbs/1,500 sq. ft.
Pole Beans	406 lbs/1,500 sq. ft.
Beets	8 oz/1,800 sq. ft.
Broccoli	360/1,440 sq. ft.
Cabbage	200/800 sq. ft.

Note: The square footage includes walkways space for each row. The seed amounts are high to account for thinning and insect problems. The chart is based on harvesting enough food for each day to feed the specified number. It also allows for field damage, kitchen wastes, and the relative popularity of the vegetables.

Source: The Prison Garden by Nancy Flinn, 1985 National Garden Association.  
180 Flynn Avenue Burlington, Vermont.

## Recipes

### Organda and Susan's Summer Time Salad

- 4 cups red leaf lettuce (cut into bite size pieces)
- 4-6 large tomatoes (cored and diced)
- 2 medium size apples (cored and cut into chunks)
- 2 tsp. lemon juice
- 1 cup sunflower seeds (unsalted and shelled).

Place the apples in a bowl and add the lemon juice (to prevent discoloration). Put the remaining ingredients into the bowl and chill for 1/2 hour. Add mint dressing just before serving.

### Shamika's Apple and Mint Relish

- 2 oranges
- 4 large apples
- 1/2 cup chopped mint
- 1/4 cup vegetable oil
- sugar and salt to taste

\* Halve the oranges and cut two very thin slices. Reserve, grate the rind and squeeze the juice from the remainder.

\* Put the apples in a bowl and immediately (to prevent them from discoloring) add 1 tsp. lemon juice.

\* Add the orange rind and the mint to the apples. Mix in the vegetable oil and season with salt and vinegar.

\* Serve chilled and decorate with the orange slices cut in half.

### Sonia's Mint Dressing

- 2 cups chopped mint
- 1 1/2 cups vegetable oil
- 1/2 cup white wine vinegar salt and pepper to taste

\* Add the chopped mint, oil and vinegar to one large plastic bottle. Shake vigorously for one minute. Salt and pepper to taste.

*Rikers Island 6.20.05*

# Chapter 6: The Herb Garden

*“It’s an outdoor pharmacy,” a student once remarked during a class on herbal remedies. “And it’s free.”*

## A SHORT HISTORY OF HERB USE

The diversity, usefulness, educational value and hardiness of perennial and annual herbs make an herb garden an almost indispensable mainstay of the prison landscape. Herbs tie us to a history of global trade, exploration, commerce, science and culture. Documented evidence of the use and preparation of herbs date back to early Babylon in 2000 B.C.; almost at the same time, the Egyptians were importing oil and spices for medicine, cosmetics, perfumes, dyes and disinfectants from regions far away as India. The Greeks advanced the knowledge of herbs as useful cures for sickness and disease in 400 BC through the work of Hippocrates, “The Father of Medicine.” By the first century AD the Greek physician Dioscorides had listed 500 plants with medicinal properties in his text *De Materia Medica*.

The Roman Empire, through the conquest of Persia, Europe and the Middle East, was a vast conduit for the spread of herbs and the knowledge of their beneficial uses. In Britain alone, it is estimated that the invading Romans introduced over 200 medicinal and culinary herbs. After the collapse of the Roman Empire, Christian monks were responsible for compiling and disseminating much of the knowledge about herbs in Europe; and attached to monasteries were “physick” gardens that grew herbs the monks used for treating common ailments.

Interest in herbs reached a peak in the 17th Century when John Parkinson published *Theatrum Botanicum* in 1640, a massive text covering up to 3,800 plants. In 1651 the herbal — *The English Physician*, by Nicolas Culpeper made an immediate impact with his theories of astrological botany and the Doctrine of Signatures. Culpeper forwarded the notion that the shape, texture and color of a plant determined its medical uses, a theory that reflected similar thought in Chinese herbals. Despite a number of recorded medical failures, and the fact that many of the recommended herbs had the opposite effect on remedying ailments, Culpeper’s work was widely accepted.

By the end of the century more scientific methods had begun to influence the study and

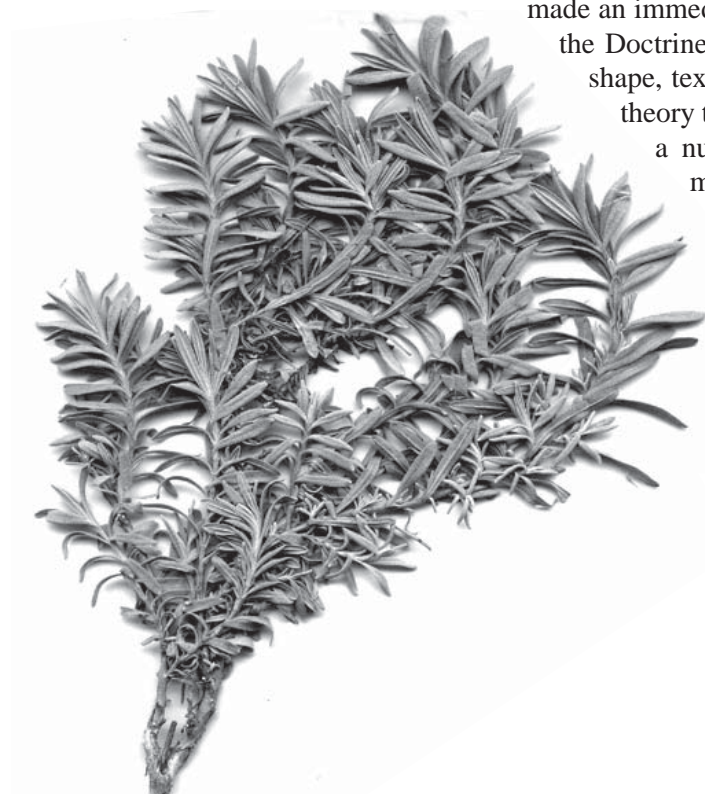


Fig. 1.  
This illustration from the 1552 Codex Barberini Aztec Herbal in the Vatican Library was reprinted by Johns Hopkins Press in 1920.

### **Ethnobotany: The study of people and plants**

As a teaching device, instruction of herbs leads into the study and science of ethnobotany. A term describing how people and their culture interact with plants, ethnobotany is in the forefront of pharmaceutical discoveries around the world. For the past three decades, ethnobotanists have focused tremendous efforts in studying Indian tribes of the Amazon Basin and their extensive use and knowledge of almost three-quarters of the world's botanical wealth.

Along with such important plant derivatives as quinine from the Cinchona tree and Curare Indians have provided medicines, food, astringents, and latex that have revolutionized Western industry and medicine. The Madagascar periwinkle from Africa is a helpful agent in child leukemia. Today, agencies such as the National Cancer Institute have supported programs that work with indigenous healers in discovering new plants and their derivative compounds which may provide important cures for cancer.

### **Richard Evans Shultes**

Any exploration of ethnobotany in modern times should not proceed without mentioning the work of Richard Evans Shultes. As a doctoral student in the late 1930s, Shultes moved to Mexico to become the first botanist to study the rituals and beliefs surrounding the sacred mushroom of the Aztecs, Teonanacatl (*Panaeolus campanulatus*). After receiving his doctorate, Shultes went to the Amazon to investigate the use of plants by different native tribes living in the lowland rainforest. It was 1941, the U.S. had just entered World War II and the embassy in Colombia had plans for Dr. Shultes. With the Japanese takeover of Malaysia, Burma and Indonesia, the U.S. supply of rubber had been cut off. The Allies had to know whether the wild stock of rubber trees existing in the Amazon could supply their need for rubber. Shultes's mission was to examine the density of rubber trees (*Hevea brasiliensis*) and determine whether the local Indians could and would harvest the rubber.

(Production of rubber had moved to Southeast Asia at the turn of the century where the trees could be grown in plantations. Insect predation and disease prevented the development of plantations in Brazil and other regions where the tree was native.)

Shultes carried out his work in his typical fashion: he traveled alone by canoe with little gear, few supplies and without weapons. He relied on his ability to forge relationships with the local tribes and not only managed to carry out his work for the U.S. military, but also continued his studies of the indigenous use of local plants in the Amazon. Shultes worked in the Amazon for an additional 14 years after the war collecting more than 25,000 plant specimens, many of economic value. He would spend months living in an Indian village and often took part in complex Indian rituals that involved plants. These experiences, often resulting in the ingestion or inhalation of psychoactive drugs led him into dissecting the hallucinogenic compounds of plant drugs with chemists and pharmacologists such as Albert Hofmann, the inventor of LSD.

Shultes never separated his work from his respect for the indigenous peoples' culture and their profound relationship with the environment. Today, his work and association with the Botanical Museum at Harvard University has made that institution a leading center for ethnobotanical studies.

### The taste and smell test

A way for students to identify many herbs is to have them crush and smell the leaf and familiarize themselves with different odors. Is the smell sweet or pungent?

Does it smell like candy or citrus, or familiar smells from cooking food? With a sweet smell, how does it taste? Smelling and tasting is one of the first steps in developing an ongoing dialogue with familiar and unfamiliar plants. Perhaps it invokes that primordial urge to use the senses in exploring the unknown and unfamiliar world as a potential food source. As one inmate said: "if it smells, it must be used for something."

medicinal use of herbs. The Worshipful Society of Apothecaries had established its famous Chelsea physic garden in London in 1673 as a living laboratory dedicated to understanding and advancing medical knowledge of plants. The settlement of the New World led to a profusion of new remedies and plants as Europeans mixed their imported seeds and knowledge with the stored wisdom of the Native Americans.

### Prison Gardening

In the garden, herbs lead us through an exploration of food, spice and medicinal discoveries that will stimulate the student's relationship to plants and gardening. Imagine wandering past aromatic plants that can help cure headaches, heal wounds, sterilize cuts, clean acne; that can be made into fragrant soap or candles, relaxing teas and culinary spices; that can relieve gas, help with indigestion and boost the immune system. For inmates who do not have access to stores and goods, let alone drugstores, and whose bathroom toiletries are standardized and generally in poor quality, the value of herbs and their productive nature makes them especially appealing. At the Rikers greenhouse, inmates are creating a facsimile of a medieval herb garden using herbs they are able to prepare and use in jail. Mints such as hyssop, peppermint and spearmint are easy to grow and along with lemon balm and feverfew, comfrey, lavender, fennel and basil are harvested throughout the summer.

Using a square 40 foot by 40 foot space, students designed, measured, and installed the herb garden, employing skills which combined their knowledge of plants with design principals and personal aesthetics. With enough space the prison herb garden can contribute enough mint, basil, lemon balm, fennel, oregano and thyme to create a small cottage industry, or at least supply the facility with culinary spices. Herbs are generally low maintenance crops that are drought hardy and often perennial. Mint for example will spread under most conditions and can be used in tea, salad dressing, garnishes and cooking spices. Basil, though an annual, responds to frequent harvests through the summer, and the amazing number of varieties make it an interesting and fragrant crop.

**Fig. 2. Rikers Island facsimile medieval herb garden. This is the actual design created by one of the students of the Green House program at Rikers Island. Exercises like this help students combine horticulture, history, design and planning skills and arithmetic into one unified project.**

The students decided to combine vegetables into the design as well, so that the garden included: rose, hyssop, mints, thyme, lemon balm, parsley, celantro, sage, squash, eggplant and peppers.







Fig. 3. In the early spring the almost completed design looked like this. Note that existing shrubs were incorporated into the design. An earlier smaller herb garden formed the nucleus of the plan.



Fig. 4. Informal gardens come in many varieties and present more of a challenge to the designer than no fuss geometric gardens. One of the many advantages is that such a garden can combine several gardens in one. In this example and the accompanying figure is one example.

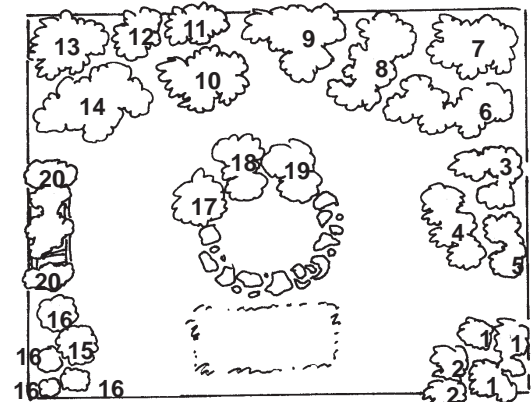
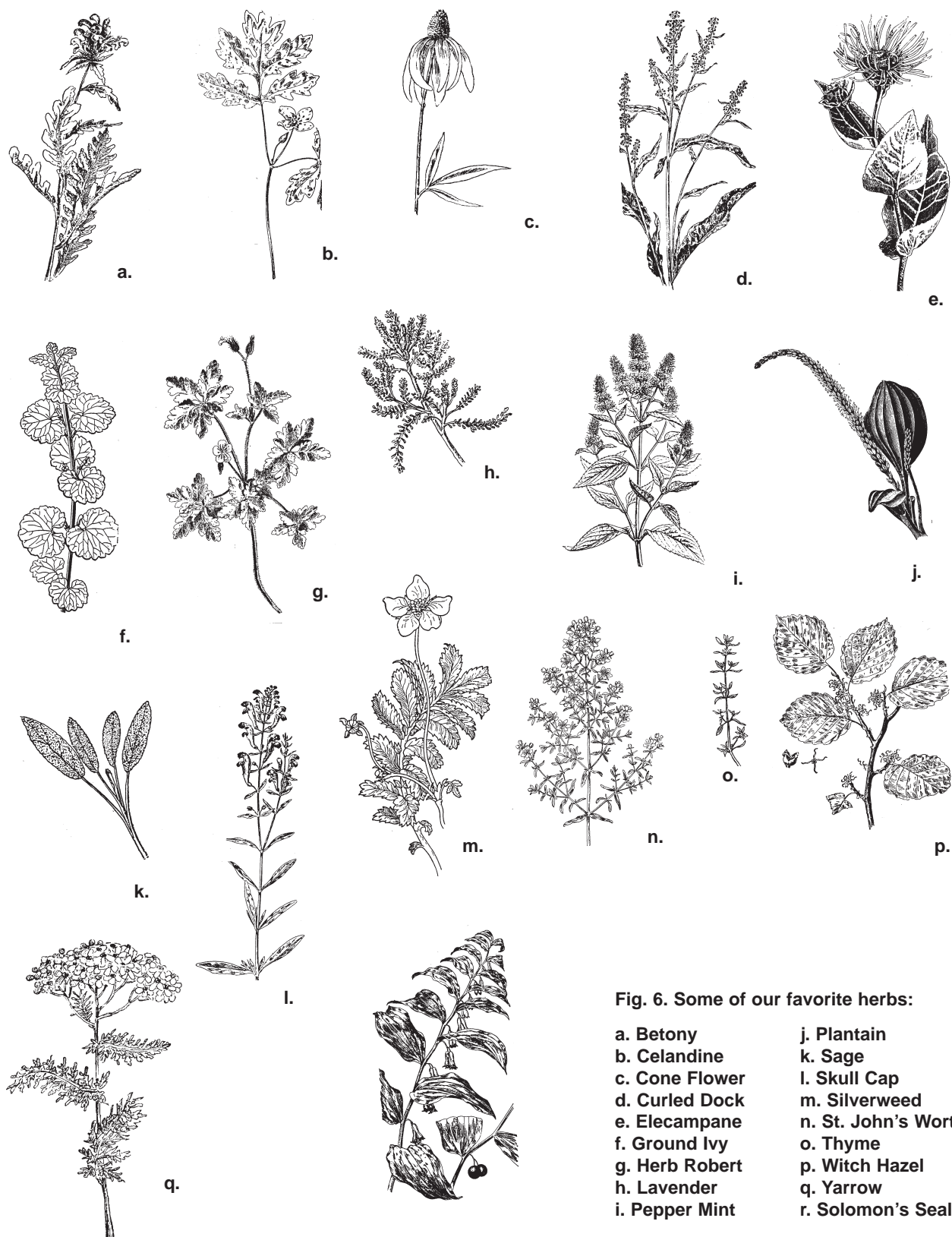


Fig. 5

- |  |                                  |
|--|----------------------------------|
| 1. Thymus<br>snow drift, aureus,<br>pink drift | 10. Salvia                       |
| 2. Mentha                                      | 11. Faeniculum                   |
| 3. Basilicum                                   | 12. Echinacea                    |
| 4. Calendula                                   | 13. Rosa                         |
| 5. Coriander                                   | 14. Rosmarius                    |
| 6. Lavendula                                   | 15. Laurus                       |
| 7. Cynara                                      | 16. Chamomelum                   |
| 8. Allium                                      | 17. Jasminum                     |
| 9. Salvia                                      | 18. Iris                         |
|  | 19. Ranunculus                   |
|  | 20. Lauricera<br>Japonica (hops) |





**Fig. 6. Some of our favorite herbs:**

- |                |                    |
|----------------|--------------------|
| a. Betony      | j. Plantain        |
| b. Celandine   | k. Sage            |
| c. Cone Flower | l. Skull Cap       |
| d. Curled Dock | m. Silverweed      |
| e. Elecampane  | n. St. John's Wort |
| f. Ground Ivy  | o. Thyme           |
| g. Herb Robert | p. Witch Hazel     |
| h. Lavender    | q. Yarrow          |
| i. Pepper Mint | r. Solomon's Seal  |

## **Exercise 1**

### **Gathering and Storing Herbs**

#### **Materials:**

- \* Selection of herbs gathered in the garden
- \* Scissors
- \* Clean paper bag
- \* String
- \* Brown glass jars

#### **Procedure:**

Gather herbs on a sunny day when completely dry. Flowers should be fully open.

#### **For Flowers-**

Pinch off or cut off flowerheads at noon when flowers are generally at their best. Place the flowers in a paper bag, tie loosely and hang in an enclosed place.

#### **For Leaves-**

Pick leaves and stalks, tie them together in a bundle and hang them upside down in a dry airy place out of the direct light. Once the leaves are dry, strip them from the stalks and crumble them up. Store them in a dark airtight container.

#### **For Seeds-**

Cut the flower stalks in fall when the flowers are well desiccated. Bundle, tie and hang stalks upside down. Catch the seeds in a paper bag tied around the stalks.

#### **For Roots-**

Dig up roots, separate from the plant and soak in cold water for about one hour. Cut into small pieces and place in a paper bag in a warm dry place until thoroughly dry. Store in an airtight container.

## **Exercise 2**

### **Preparing Remedies**

#### **Making Tea**

We grow an inordinate amount of lemon balm, sage and mints of all kinds. Beside their medicinal value, there is something homey and comforting about tea. Herbal teas can be kept for up to one day and are effective either hot or cold.

Put fresh leaves or sprigs of dried herbs into teapot and pour boiling water over them. Steep for 10 minutes. Never boil tea leaves. Strain and drink.

#### **Making Syrups**

Syrups are very soothing and therefore are beneficial for throat and different stomach ailments. Make a strong tea (steep for 20 minutes) with about 5 ounces of herbs to one pint of water. Strain into pan and add a cup of honey or sugar. Stir slowly over heat until syrupy. Store in dark glass bottles.

#### **Preparing a Decoction**

Cone flower (*Echinacea purpurea*) and

Witch Hazel (*Hammamelis virginiana*) are both potent medicines that the medical profession is slowly accepting for conventional treatments. The medicine, which in echinacea helps boost the immune system, is extracted from the roots.

To prepare a decoction, place the roots or bark in a saucepan and add cold water. Bring to a boil and lower the heat. Simmer for 20 minutes (the liquid will reduce by about one-third). Strain into a jug and let cool. Store in a cool place. The residue of bark and roots can be composted.

#### **Hot Infused Oil**

Heat speeds up the process of infusion, a system used by the Egyptians thousands of years ago as a method of making perfume. Eight ounces of lavender will infuse into one pint of oil. The infused oil can last up to a year if stored in a cool dark place.

Begin by simmering water in a pan (don't boil). Place a bowl with herbs and one pint of oil, into the pan. Simmer for three hours. Strain through unbleached muslin. Funnel it into the dark bottle.

## Herbal Remedies

Source: Herbal Remedies in Pots, Effie Romain & Sue Hawkey. DK Publishing inc. New York, 1996

### Sore throat, cough and cold

Colds are a fact of life. More annoying than harmful, there are no actual cures and no better remedies than those you can make yourself. In jails, where there is a high concentration of people, in an indoor confined space, colds spread like wildfire. The oils in the following herbs have a clearing effect on the nose, throat and chest. Sage has diuretic properties and thyme and elecampane break up mucus.

The constant interaction which takes place between people and plants in an herb garden, is an excellent way for students to generate a strong understanding and discernment of the history and use of their botanical world.

Herbal Remedies

### Fevers and Flu

Flu of course, is a lot more serious than colds and the prison setting is a great place for the flu to thrive. Dry plenty of herbs in the summer so you'll be ready when the flu season hits. Cone flower has natural antibiotic effects. Astringents like plantain reduce phlegm, and yarrow brings down fever by inducing a beneficial sweat.

Herb	Method	Dose
Plantain and Yarrow combination	strong tea	3 or 4 times a day while symptoms persist
Coneflower root, False indigo root	decoction	1 cup 3 times a day during a flu

### Chills

The combination of overheating and draft that is the hallmark of Rikers Island architecture is the best way to develop a chill. Discovered in the last century by military physicians, the full workings of the vital compound vitamin C are still not yet completely understood though universally acknowledged. Horseradish and nasturtium are both rich in vitamin C. Their mustard-like oils foster a kind of warmth that helps fight colds.

Herb	Preparation	Dose
Horseradish	Grate root, steep in vinegar, seal in a jar	1 teaspoon to 1 cup hot water
Nasturtium	Handful of frozen flowers to 2 cups boiling water	1 cup 3 times a day

### Indigestion

Any one who has had to exist on a diet of jailhouse food knows about indigestion. Although we try to supplement the diet with our own home-grown organic vegetables, there are still plenty of times when the mess hall is the only place to eat. Peppermint, one of the most common and easy to grow herbs, is also one of the most effective remedies for stomach troubles. Mugwort and marshmallow are soothing; meadowsweet is analgesic (avoid if allergic to aspirin).

Herb	Method	Dose
Peppermint	tea	you can drink the whole pot
Meadowsweet, mugwort, peppermint	strong tea	2 times a day
Marshmallow	syrup	1 teaspoon as needed

## Constipation

A diet poor in fresh raw vegetables usually leads to this common and uncomfortable condition. Eating produce from your garden is the best remedy but realistically not always possible. Encouraging regular evacuation is one of the oldest and yet-to-be-improved-upon methods of regulating the system. Never force evacuation; instead promote regularity by increasing bulk intake while relaxing the bowels. Flaxseed, chamomile and peppermint all help along this process.

Herb	Method	Dose
Flaxseed	mix with cereal	every day over several months
Dock Root	decoction	Three times a day as needed
Chamomile flowers, peppermint sprig	strong tea	Three times a day

## Diarrhea

Another common condition is diarrhea. The tannins found in all these herbs will slow down the diarrhea. Remember diarrhea will cause you to dehydrate so be sure to drink plenty of water mixed with a bit of sugar and some lemon juice. Great burnet and Solomon's seal provide some nourishment as well.

Herb	Method	Dose
Herb Robert, Great Burnet, Silverweed	strong tea	3 times a day
Solomon's Root	eat raw	Eat during an attack of diarrhea
Great Burnet, Solomon's Seal	decoction	1 cup 3 times a day until attack passes

## Hemorrhoids

Forcing an evacuation during constipation can cause or aggravate piles. Childbirth often causes them as well. Astringents like Celandine and Witch Hazel will help shrink them. Marigold and peppermint will reduce swelling and bring relief of pain and itching.

Herb	Method	Dose
Pot Marigold, Celandine, Witch Hazel	ointment	Use as needed
Pot Marigold, Witch Hazel leaves	strong tea	1 cup 3 times a day as needed

## Tension

The tension of incarceration is one of the most terrible residues of prison life. Worrying about what is going to happen to you inside, what is going on outside to your family, and what you can expect to happen when you return to your community is almost unavoidable. Nature in her wisdom has provided some help. Skullcap calms, betony relieves headaches, chamomile and lemon balm relax nervous stomach. The ancients believed that the aromatherapeutic qualities of lavender lift the spirits by inducing forgetfulness.

Herb	Method	Dose
Lavender, Chamomile	strong tea	1 cup three times a day as needed
Betony, Skullcap, Lemon Balm	strong tea	Hot or cold 1 cup 3 times a day

## Depression

You don't have to be incarcerated to feel unhappy. We often drive ourselves crazy trying to make ourselves happy. The concentration required for gardening promotes relaxation; the herbs grown in the garden have their own beneficial qualities. Traditionally St. John's wort was prescribed for melancholia. Betonia restores the nervous system. lemon balm and lavender both promote relaxation.

Herb	Method	Dose
Lemon Balm, Lavender flower (1)	tea	1 cup 3 times a day
Betony leaves or flowers (3)	tea	1 cup 3 times a day
St. John's wort	tincture	1 teaspoon 3 times a day (2 months maximum)

# Chapter 7: The Butterfly Garden

*“Planning and maintaining the habitat of butterflies brings student horticulturists closer to the natural world and strengthens their understanding of ecology and science”*

## BUTTERFLY GARDEN

If nature is drama, then butterflies are principal actors who bring the garden alive in a dynamic and aesthetic manner. Unlike formal gardens with their fragrant roses and flowering hybrids, butterfly gardens are reliant on a jumble of flowering plants that provide nectar for the butterflies all season long, as well as habitat and food for their larvae – the caterpillar. A small flowering plant hovering in the corner of the garden may be considered a weed, but it also might be an important food source for a fritillary, swallowtail or monarch. Attracting butterflies to the garden, especially in isolated areas like the yard of a prison, demands a greater understanding of what butterflies need to survive and proliferate. What do butterflies eat? Which kind of plants do they lay their eggs on? What does the larvae need for survival and its stage of metamorphosis as it transforms into a chrysalis and butterfly?

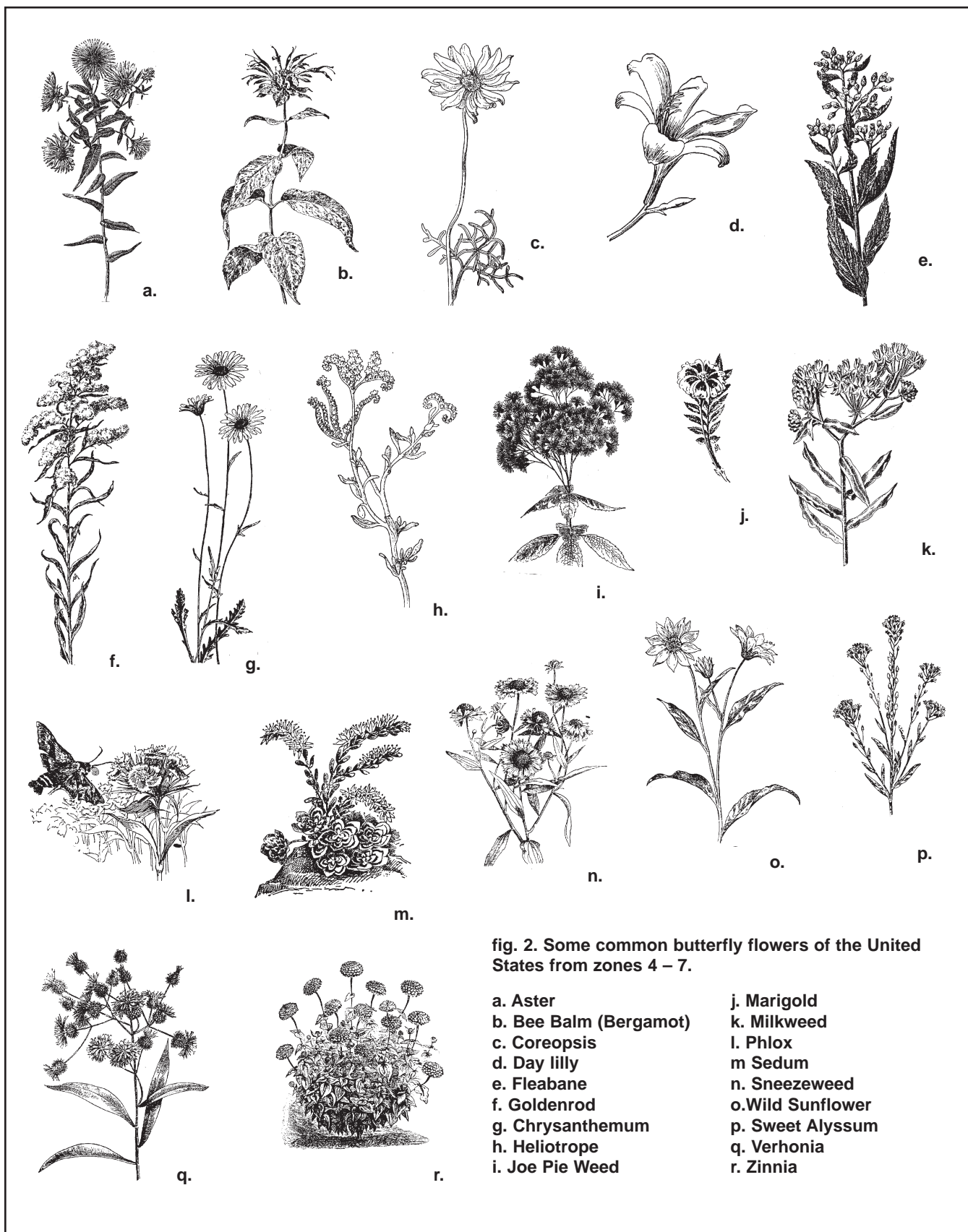
Planning and maintaining the habitat of butterflies brings student horticulturists closer to the natural world and strengthens their understanding of ecology and science. The creation of these gardens helps mitigate the loss of native landscapes and provides vegetative corridors that may ensure the long-term survival of different butterfly species. Not only do butterflies have important roles as pollinators, but they are also early indicators of ecological threats to the environment. Their presence in the garden is an indication of diversity and a healthy functioning system.

## Butterfly Plants

Plants may serve as nectar sources for butterflies, host plants for caterpillars or food for both. To increase the number of butterflies in your garden increase the number of host plants and nectar sources. Here are just a few:







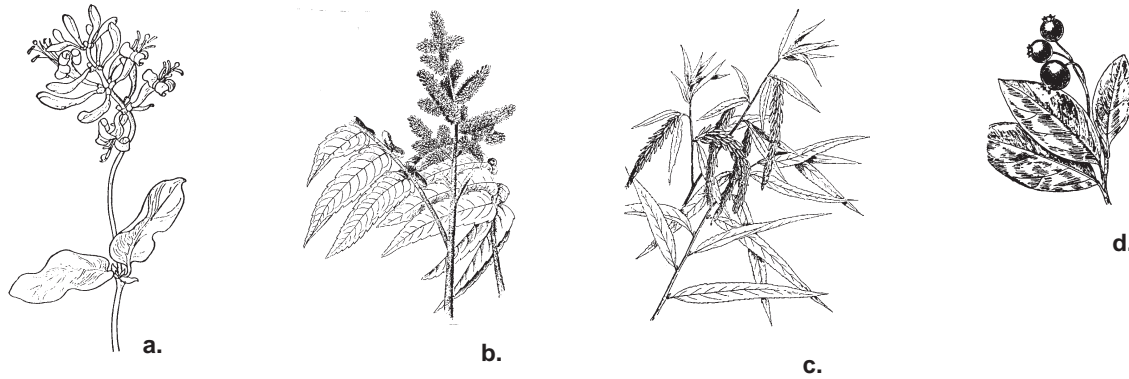


fig. 2. Some common butterfly shrubs and trees of the United States from zones 4 – 7.

- |                 |                   |
|-----------------|-------------------|
| a. Honeysuckle  | c. Salix (Willow) |
| b. Rhus (Sumac) | d. Vaccinium      |

### Perennials and Annuals

One way we tried to increase the variety of butterfly species in our garden was to plan for a series of seasonal changes in the flowering species present in your garden. Here are a variety of flowering plant, shrubs and trees which bloom throughout the pring and summer.

*Aeratum houstonianum* (ageratum)  
*Alcea resea* (hollyhock)  
*Asclepias* spp. (milkweeds, butterfly weed)  
*Aster* spp. (asters)  
*Budleia* spp. (butterfly bushes)  
*Chrysanthemum leucanthemum* (oxeye daisy)  
*Chrysanthemum x superbum* (shasta daisy)  
*Coreopsis* spp. (coreopsis)  
*Echinacea purpurea* (purple coneflower)  
*Erigeron* spp. (fleabanes)  
*Eupatorium* spp. (bonesets, Joe-Pye weeds)  
*Grindelia* spp. (gum weeds)  
*Helenium autumnale* (sneezeweed)  
*Helianthus* spp. (sunflowers)  
*Heliotropium arborescens* (common heliotrope)  
*Hemerocallis* spp. (daylilies)  
*Lavandula* spp. (lavenders)  
*Lobularia maritima* (sweet alyssum)  
*Mentha* spp. (mints)

*Monarda* spp. (bee balms)

*Phlox* spp. (phlox)  
*Rubedkia* spp. (coneflowers)  
*Salvia* spp. (sages)  
*Sedum spectabile* (showy stone crop)  
*Solidago* spp (goldenrods)  
*Tagetes patula* (french marigold)  
*Thymus* spp. (thymes)  
*Verbena* spp. (verbenas)  
*Verbonia* spp. (ironweeds)  
*Zinnia* spp. (zinnias)

### Trees and Shrubs

*Chrysothamnus nauseosus* (gray rabbitbush)  
*Lugustrum* spp. (privets)  
*Lonicera* spp. (honeysuckles)  
*Rhus* spp. (sumacs)  
*Salix* spp. (willows)  
*Syringa vulgaris* (common lilac)  
*Tilia americana* (baswood)  
*Vaccinium* spp. (blueberries)

Planning and building a butterfly garden demands a good understanding of the types of plants and habitat butterflies need to live, produce eggs (the ovum) and transform from caterpillar (larvae) to the chrysalis (pupae) and back to a butterfly (adult). Nectar for adults, foliage for the larvae and cover for the pupae are of course necessary. But butterflies also need windscreen plants to shelter from the wind, sunning spots (stones for example) and water for drinking. Building a small rock pool is a worthwhile project for students. The pool should be lined with plastic to prevent the water from draining but be shallow enough to evaporate the water before it stagnates with mosquitoes and algae.

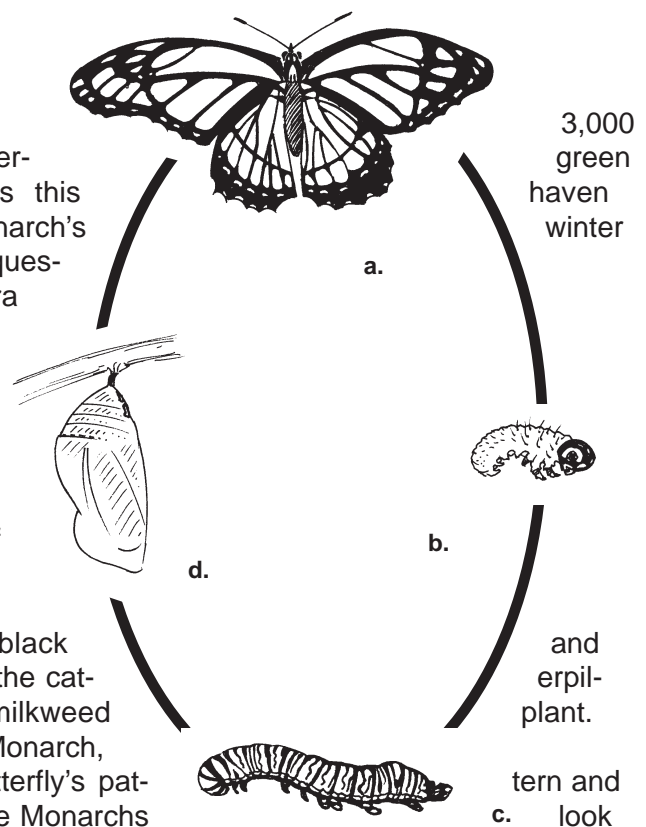
It is important for students to identify caterpillars to determine whether they are a garden pest or a desirable butterfly in-waiting. Spraying a bacterial pesticide on what might seem to be an area abundant with striped parselyworms munching on your dill and carrots would wipe out the beautiful black swallowtail. Once properly identified, caterpillars can be removed by hand and placed to another part of the garden -a spot that could be specifically planted with their food and used as an exclusive feeding ground.

### Flight of the Monarch

Perhaps the best known species of butterfly, the monarch is the only migratory species, flying up to miles to reach its wintering grounds high in an ever-forest in Mexico's Sierra Mountains. For years this was a well-kept secret. Scientists knew of the monarch's migration, but exactly where they wintered was a question that seemed to elude them. Locals in the Sierra Madres however, were familiar with the clouds of black and orange monarchs that would descend each winter in their mountain stronghold. It was only a matter of time before two scientists, moving in tandem with the migrating butterflies, and often at opposed and competitive viewpoints, finally tracked them down to a stand of oyecher trees in the mountains near Mexico City.

Most birds learn to leave the handsome black orange Monarch butterfly alone. Monarch larvae -the cat-lar—store poisons in their bodies from the milkweed. Experiments have shown that once a bird eats a Monarch, the bird will not touch a Monarch again. The butterfly's pat-color are memorable, the bird remembers what the Monarchs like—and also remembers not to touch them.

Today the Monarch Site is a web-based site for classroom involvement in raising and tracking monarch butterflies.



**Fig. 4 Life cycle of the Monarch butterfly.**

- a. Adult butterfly
- b. Larva
- c. Catterpillar
- d. Chrysalis

### Exercise 1

#### Identifying appropriate nectar sources for butterflies in your home range.

##### Materials:

- \* A good butterfly book
- \* Notebook
- \* Butterfly net

##### Procedure 1:

- \* Research butterflies that range in your area
- \* Cross reference their favorite nectar sources
- \* Prepare a list of nectar sources that they favor

##### Procedure 2:

- \* Hunt and capture butterflies.\*
  - \* Identify them using a good source book.
  - \* Create a list of their favorite nectar sources.
- \* captured butterflies should be handled with extreme caution, then released immediately.

### Favorite butterfly gardening book

*Butterfly Gardening, Creating a Butterfly Haven in Your Garden*, by Thomas C. Emmel, Ph.D.

Friedman/Fairfax Publishers  
1997 by Michael Friedman Publishing Group, Inc.

Dr. Emmel's book is just one of many, many wonderful books on the fascinating subject of butterfly gardening. The book is lavishly illustrated with color photos and is full of easy to understand information on how to:

- \* Design a butterfly garden that is attractive to people and butterflies.
- \* Select plants that butterflies in your area will flock to.
- \* Lure different species to your garden.
- \* Plant appropriate larval host plants and nectar sources for your butterflies.
- \* Care for your butterfly garden.
- \* Learn about the species that visit your garden by keeping a journal.



fig. 5. A small butterfly garden at Rikers Island. We try to include butterfly features into as many gardens as we install. Part of our mission is to restore the ecology of the island. The local butterflies have increased each year.



## Exercise 2

### Ten Guidelines For Ideal Butterfly Gardening

#### Materials:

- \* A good butterfly book
- \* Notebook
- \* Butterfly net

#### Procedure 1:

- \* Observe butterflies in your area or existing gardens and see which flowers they prefer.

#### Procedure 2. Design a butterfly garden which incorporated these basic principals

- \* Butterflies like sun, so position plants in a sunny area sheltered by wind.
- \* Grow large clumps of the preferred nectar-bearing plants.
- \* Grow large clumps of larval plants.
- \* Try to mix up the diversity of plants, their height and color.
- \* Choose plants for different and extended bloom periods.
- \* Provide a mud puddle as a source of drinking water and salt.
- \* Keep areas aside for weedy plants that are beneficial for larvae and pupae.
- \* Know the names of different caterpillars and distinguish between defoliating pests and butterfly larvae.
- \* Avoid or limit the use of pesticides.

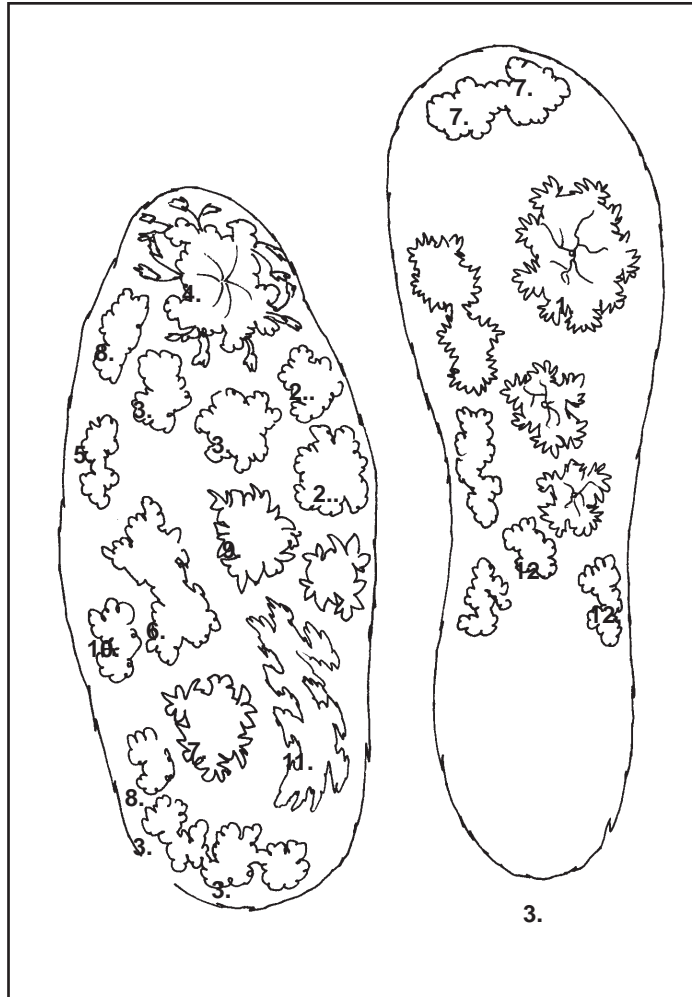


Fig. 6. A rough sketch of the kind of plants and shrubs that might be included in an informal butterfly garden design of the northeastern United States.

- |               |                |
|---------------|----------------|
| 1. Willow     | 7. Mints       |
| 2. Asters     | 8. Snapdragons |
| 3. Verbena    | 9. Smoke tree  |
| 4. Buddleia   | 10. Violets    |
| 5. Heliotrope | 11. Fennel     |
| 6. Milkweed   | 12. Zinnia     |



## Chapter 8: The Arbor

*“It’s good to know that someone will someday be here to enjoy it, but not me. I’ve left something behind that I have no interest in coming back to see.”*

*Inmate after planting a tree  
— Rikers Island*

Trees lend a dynamic structure to the garden that is symbolic and aesthetic as well as ecologically vital for maintaining a largely diverse plant and animal community. The tree, with its vertical shapes and spreading crowns, the silhouette of deciduous trees in winter or the deep green of conifers in the snow, the flowers of spring and the fruit of summer, the foliage of autumn, makes a powerful statements in the prison landscape.

But apart from their more natural attributes, trees provide a symbolic link between inmates and the immutable nature of time. It is this connection that allows inmates to interact and reflect on life and its consequences in a powerfully new way. Planting a sapling that will reach a level of maturity in 80 years-time, or a tree that will one day reach 90 feet or more is an overwhelming concept to students who often view life in snap-shot moments. Trees imply commitment and slow growth, their enormity laying somewhere in the future. The act of planting a tree is a responsibility that will have effects on the environment for the next century, and that impact is transferred to the inmate’s own experience of change, growth and maturity.

But planting trees in prison is often problematic. Large trees often impede or block site lines, which is often viewed as a security risk. Trees take planning. Under wires, eaves, next to fence lines, near buildings where windows could one day be obscured are sites that should be avoided.



## Exercise 1

### Tree Care and observation

Source: Pam Ito Apple Seed Instructor HSNY

#### Materials:

- \* fertilizer
- \* trowels
- \* cultivators.

#### Procedure 1

##### Cleaning and caring for the ground around trees

- \* Clean the area around trees carefully as there may be broken glass present if you are in an area where land fill has been used to create soil.
- \* Aerate the soil with cultivators. Once soil around trees becomes compacted or if it is very clayey to begin with, roots may not get the air they need to survive. Don't worry if you expose some of the shallow roots; just make sure that you cover them over again with soil.
- \* Try and use organic fertilizer or better yet compost you have made yourself, as it will lend disease resistency to the tree's roots. In any case, if you are using commercial fertilizers follow instructions.
- \* Repeat these steps in spring and fall.

#### Procedure 2

##### Observation

- \* Take the girth measurement at adult chest height to mathematically estimate the age of the tree.
- \* Identify the trees using a good book or material obtained from extensionists or forest department. Collect a few of each leaf. If it is winter, collect some buds.
- \* If time permits, form a circle in the garden and read tree legends.

## Beliefs About Trees

I remember reading a Scandinavian myth when I was a kid that told how heaven and hell were linked to earth through Yggdrasil, the ash tree. Drinking the water that ran among the roots gave knowledge. Christians believe that the cross upon which Christ died was propagated with seed passed down from the tree of paradise, the tree of everlasting life. In ancient Greek myth Daphne turned into a laurel tree to escape Appolo. Today the laurel is still associated with victory. The tree goddess was worshipped in Hindu shrines many years before Christianity and the Banyan tree was worshipped as a god. For the Druids it was the oak. Nut, goddess of immortality dispenses her magical elixir from the Egyptian Tree of Life – a sycamore fig. In one version of the fairy tale Hansel and Gretel it is the Juniper tree that springs up where the bones of Gretel's brother Hansel are buried through wich later, the boy is brought back to life. In Cinderella – a tale that is especially poignant for disenfranchised individuals – it is the tears of Cinderella that causes the sprig of hazel which her father brings to her to become in her mother's garden a full grown tree – overnight.



**Fig.1. Fleeing from Apollo, Daphne is transformed into a laurel. Pollaiuolo, fifteenth century.**

## HOW DOES A TREE GROW

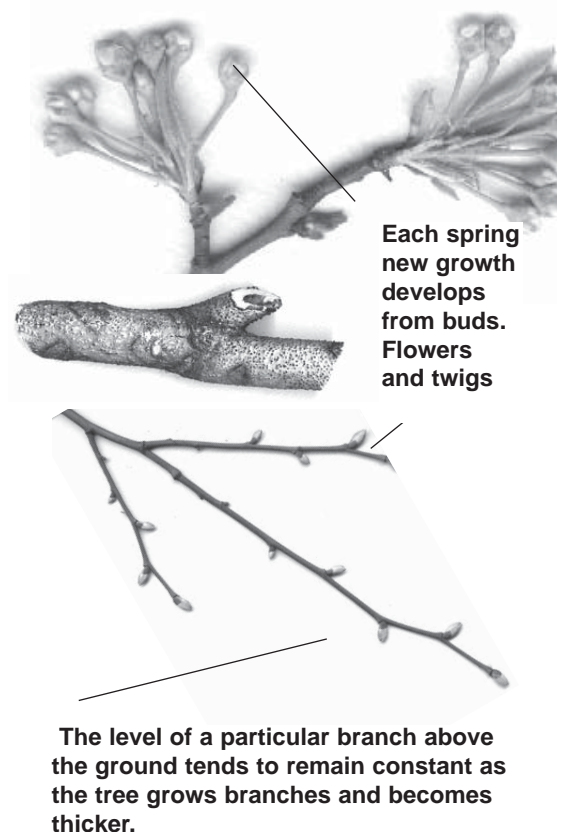
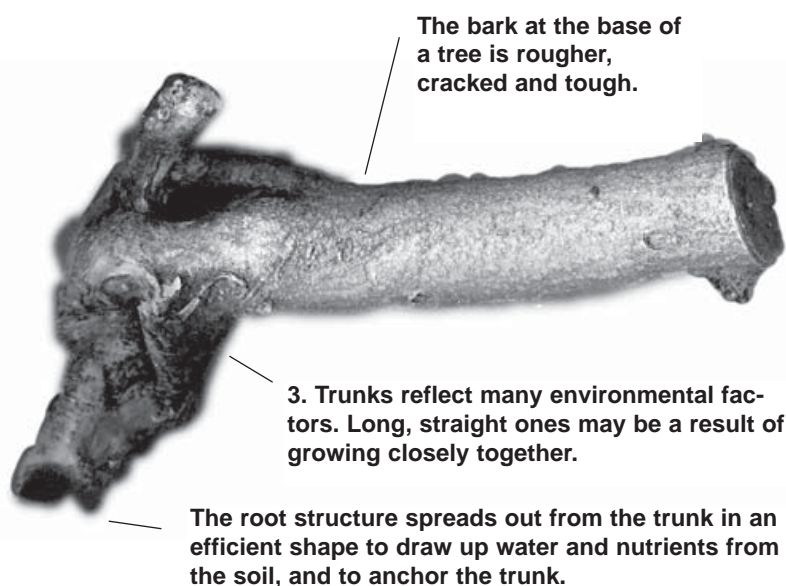
Despite their immobile nature, trees – during the growing system-are constantly in action. Apical meristems create rapid cell growth which elongate the branches. This growth, often referred to as primary growth, ensures the leaves will quickly extend into sunlight and the roots penetrate the soil. Lateral meristems are equally busy but not as quickly noticeable. Located through the length of the stem, lateral meristems add girth – also called secondary growth – to the stem and branches which support the height and spread of a quickly growing tree. The girth of most mature tree trunks increases by roughly 1 inch each year.

Branches and stems only elongate at the tips. This means that once a branch has grown out from a trunk it will always be at the same height above the ground. Though the trunk may get much thicker it does not lift the canopy upwards as it gets older. Rather, the branches fall off at the bottom as the tree ages, so it often seems that the lowest branches are slowly being lifted upwards.

### Leaves

The signal trait of deciduous trees is their yearly habit of rebirth and regeneration, in counterpoint to the conifers which never lose their leaves. And the characteristic trait of leaves is their color – green. But besides the chlorophyll, there are other auxiliary pigments: carotenoids, which are orange, yellow or red; and xanthophylls of yellow; and anthocyanins, which are scarlet, purple and blue. Changes in the proportions of these pigments in preparation for the mysterious process of shedding the summer's growth is what causes the autumn blaze of color in some trees. In some years, the colors are much stronger than in others; this may be due in trees like the cherry to differences in weather between years. A single tree like ironwood may contain reds oranges and yellows; other trees like some American maples may change a uniform brilliant color as a result of the effect of extreme climate changes that stimulate the conversion of anthocyanins resulting from sugar production. Although a great deal of

**Fig. 3. Illustration of a deciduous tree. A tree is made up of many parts, all working together to make it grow. The leaves make food using sunlight and gasses in the air. The roots take water and minerals from the soil. The leaves need water to do their job, and the roots need food to help them grow.**





energy is expended year after year in deciduous leaf production, not much concern goes into protecting these leaves, probably because they will only be discarded. Conifers, however, require elaborate process for developing the resins that act as antidessicants to the leaves.

In temperate regions, a possible way to integrate trees in the prison garden is to set aside an area for a small arbor using understory species that do not reach the dramatic heights of major canopy trees. The arbor can consist of dogwoods (cornus spp.), redbuds (cer-sis), serviceberry (amelanchier), magnolia spp., mountain ash (sorbus spp.) dwarf junipers and cedar (juniperus and chamaecyparis) to name a few. It is also our experience that planting fruit-bearing trees (dwarf varieties) is effective in stimulating the students' overall interest in trees and tree care. The reward of course is seasonal, appearing in the edible form of delicious fruit. A mixed planting of pears, peach, apple, apricots, plum and cherry can yield a stream of fruit all summer long and create yearlong interest with winter maintenance, spring flowers and fall color.

Overall, the arbor provides students with a prevailing opportunity to learn about and develop skills in tree care. For inmates with an interest in horticulture, the importance of these skills cannot be understated. Tree care is a year-round multi-million dollar business in the U.S. and offers a variety of well paying jobs for climbers, pruners,



**Buds and flowers eventually become leaves.**

**The newer bark closer to the top is smoother, finer.**

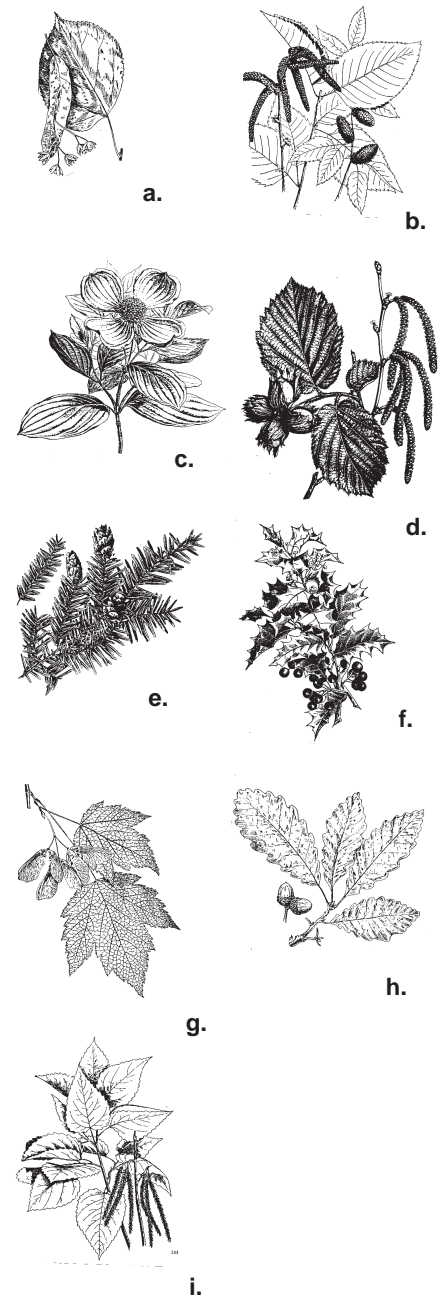


Fig. 4. Some common trees of the Northeast all of which have distinctive seeds and fruits.

- |                    |                  |
|--------------------|------------------|
| <b>a. Basswood</b> | <b>g. Maple</b>  |
| <b>b. Birch</b>    | <b>h. Oak</b>    |
| <b>c. Dogwood</b>  | <b>i. Poplar</b> |
| <b>d. Hazel</b>    |                  |
| <b>e. Hemlock</b>  |                  |
| <b>f. Holly</b>    |                  |

## Exercise 2

**Find, identify, and print leaves at your site.**

### Materials

- \* water paints
- \* paper
- \* leaves from trees at your site
- \* bowls and sponges
- \* newspaper

### Procedure

- \* Arrange the leaves (or buds) collected in the first exercise or blown into it from outside.
- \* Sort them by group and family. If you are using buds, set some aside to force in jars of slightly warmed water. Both buds and the young leaves of buds obtained from forcing are good for this exercise
- \* Press them between books or weighted boards for about a week.
- \* Mix paints with water, half and half. Approximate the colors of the actual leaves which should be pressed flat and dry by now. If you are working in the autumn, you will have more variety. Pour some paint off into bowls.
- \* Gently dab the leaves with the sponges dipped in color.
- \* Lay the painted sides of the leaves down on the paper and use a sheet of newspaper to press your leaf firmly enough to make an impression.
- \* Label them according to your identification. Bind them into a book for future reference.

surgeons and planters. Maintaining a small arbor integrates a number of skills that inmates can later use for employment and be certified for through professional associations.

## CONIFERS

Conifers produce their seeds slowly. To protect this process, they have evolved the distinctive hard cone. In certain conifers such as the pines the cone may fall to the ground intact, once they have released their seeds. Other cones are almost never found complete on the ground because they fall apart on the tree; this is the case with the cedars.

The cone is actually the product of the female “flower.” They grow in groups from developing shoots. This explains why cones are often found in pairs – as the cone develops over a period of years, new shoots continue the process of growth and reproduction along their length.





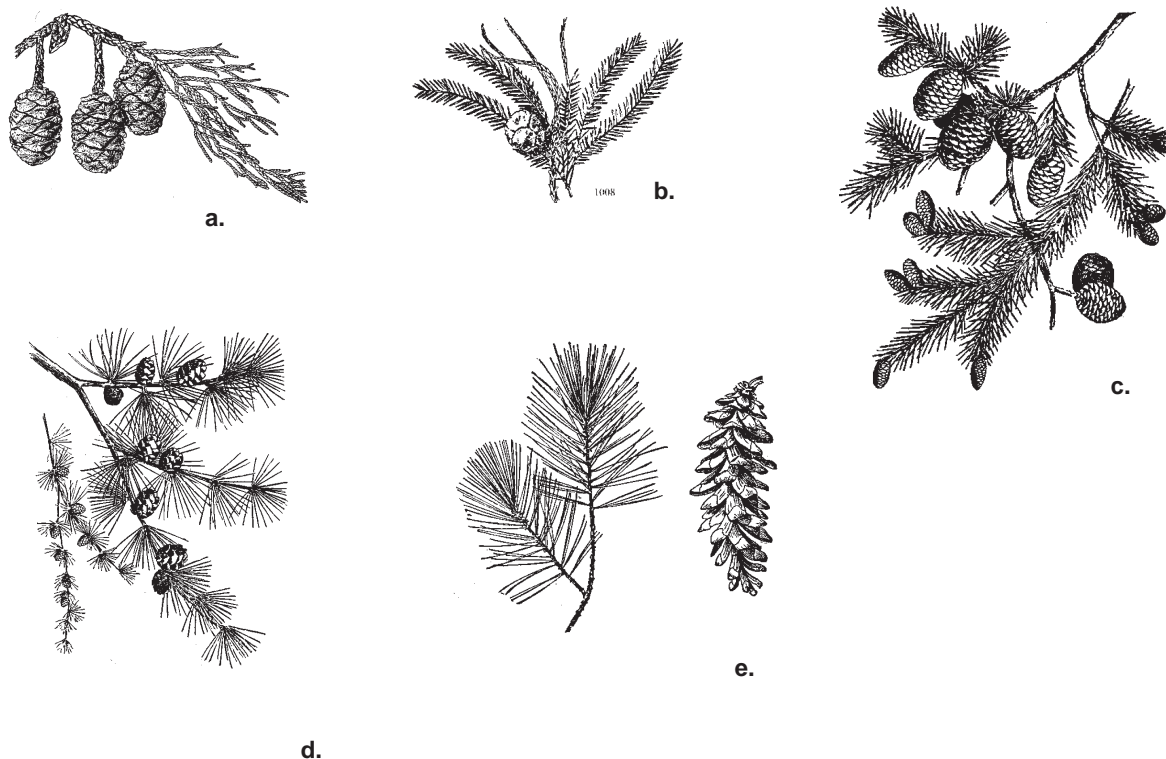


fig. 5. Some common conifers found throughout the United States in zones 4 – 7.

a. The giant sequoia has inconspicuously small cones that ripen slowly; they take two years to complete the process.

b. Cypress cones have 6 – 8 scales that open slowly, parting from each other as the cone matures. They grow in clusters.

c. Spruce cones may be large or small, but always soft and flexible. They remain on the tree only a

short time after dropping their seeds.

d. Cedar cones are easily identified by the fact that they sit upright on the branch. They share some of the durability of the wood itself, taking many years to disintegrate on the tree, after a full three years to develop seeds. This is noticeable on the larch. As the leaves fall away in autumn, notice the greenish cones. They appear

at the tips of the branches while older brownish cones remain further back.

e. The white pine weighing in at about 3 ounces and up to 6 inches long is one of the most common of all conifer cones found in the northeast."

## Weather Predictor

Folklore has it that the pine cone will forecast the weather and in fact there is truth to this assertion. Since the cones release their seeds in dry weather, a tightly closed cone anticipates wetter weather continuing.



## FRUIT TREES

There are many good reasons to grow your own fruit. You will be able to harvest your crop at the peak of perfection. By choosing the correct cultivars, you can have fruit throughout the season. They are ornamental and beautiful, known for their blossoms. Fruit trees need care. Pruning must be done annually, and with the exception of some natives like paw paw, they require full sunlight pretty much all day.

### Exercise 3 Choosing a site to plant fruit trees

#### Procedure

- \* Note down these criteria: full sun, well-drained soil, adequate space.
- \* Anticipate these potential problems: any spot recently vacated by another fruit tree, healthy or not will leave things in the soil that will affect the next fruit tree planted there; wild fruit trees in the area may share diseases with their cultivated cousins; not all inmates will be able to eat the fruit your trees produce, so don't tempt them by letting trees grow into community areas.
- \* Map out an area at the site that fulfills all the above criteria,
- \* Study catalogs to choose trees that have the best chance for survival and talk to local people to try to find out which varieties have traditionally done well in the area.
- \* Make a list of possible trees and their best location in the garden.
- \* See if any of the fruit and nuts collected for the earlier exercise meet the criteria listed above.

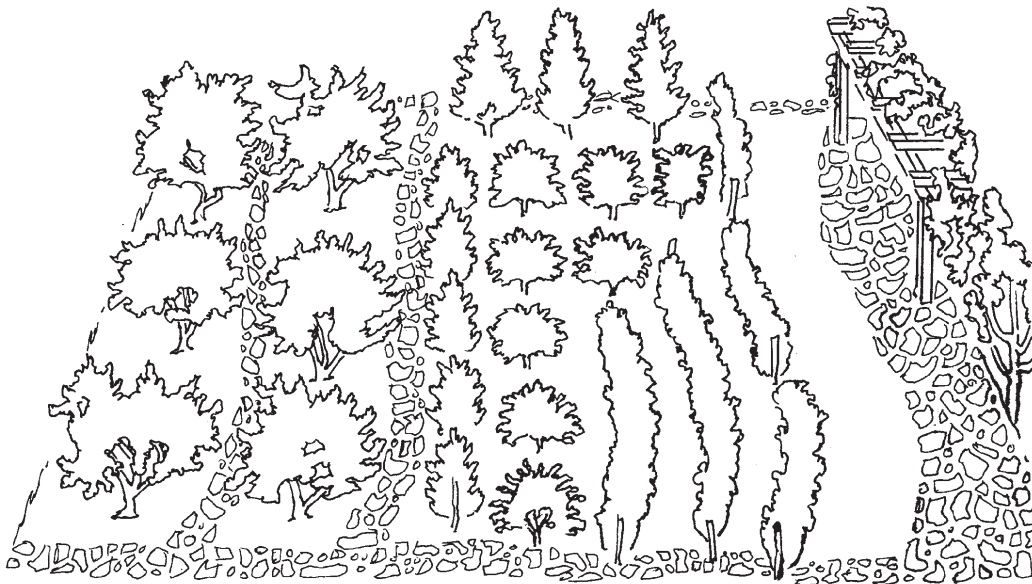


Fig. 6. A large northeastern orchard might look something like this.

Apple and pear trees

Plum and nectarine trees

Raspberries and blackberries

Grapes

**Here are a few fruit trees that are known to thrive with less attention than most large cultivars.**

**Cornelian cherry** trees bear yellow flowers in spring and produce small plum-like fruit.

**Jujube** produce a small apple-like fruit, or if left to hang longer, become more like dates.

**Pawpaw** needs no pruning. Its fruits have a tropical flavor some people describe as a cross between pineapple-banana.

**Pears** are very resistant to pests, and also do not need extensive pruning.

**Quince** trees also resist pests well and their fragrant and delicious fruit are eaten cooked.

**Tart cherry** will attract birds to your garden. They are very productive for their size.

**Fig trees** can survive cold climates with some care and their fruit is eaten either fresh or dried.

## **Exercise 4**

### **Collecting Fruits and Seeds**

There are a variety of ways in which tree fruits and seeds travel from the parent plant. Some have wings while others have plumes, pods, fruits or edible seeds.

#### **Materials**

- \* Winged seeds like those of the maple, basswood, pine and fir
- \* Edible seeds like acorns, hazelnuts, beech nuts and horse chestnuts, and berries such as blackberry, ivy, holly, rose hip, juniper, dogwood, and elderberry (never eat wild berries)
- \* Plumed seeds like dandelion, birch, willow and poplar
- \* Pods like black and honey locust
- \* Fruits like apple, orange, pear

#### **Procedure:**

- \* Compare how far seeds with one wing travel compared with those that have two wings. Try indoors versus outdoors.
- \* Compare the way the seeds are protected, and whether there is only one seed or more than one.
- \* Blow a plumed seed head and watch how the seeds scatter and are caught on the wind. Estimate how far they travel.
- \* Compare how the seeds within different fruits are dispersed. How are they protected
- \* Save some of each type of seed to propagate later on.

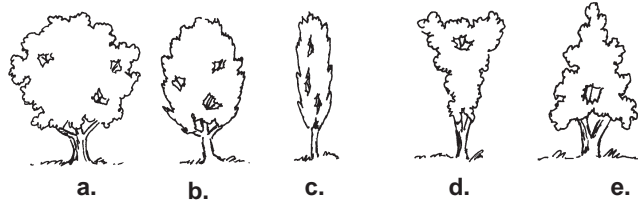
## PUTTING IT ALL TOGETHER

Trees, more than any other plants, give a garden a sense of permanence and maturity. Understanding the place of trees in the garden ecology and planting and caring for them links us to the broader external landscape. There is an incredible diversity of trees. They vary in the height, structure, and sculptural focus they give to a garden design. Their distinctive silhouettes create a contrast to the softer forms of other plantings, from the dark austere form of a pine to the blazing northeastern colors of a maple. Trees can be grown in as many ways as there are gardens, from an evocative woodland setting of birches and pines to a formal avenue of elegant and logical lindens. Sometimes, like in the case of the dogwoods, even a single specimen is strangely compelling. No matter how you choose to use trees in your garden, choose the trees you will plant carefully.

Ornamental trees are grown as an exercise in nurturing ideal beauty. Fruit trees are graced by delicious food. shrubs and trees are sometimes not easy to distinguish between, often, both give beautiful blossoms. Selecting and planting trees is a major design decision. Not only do they have to work together, but they must also work with the other plantings in your garden. Unless you relish a challenge, choose trees that are native to your site or zone. Instead of choosing exotics, seek ways to create variety of design by observing the heights and colors of trees. Get to know which ones bear colorful blossoms. Think of them as living sculptures. Explore their ability to anchor parts of your garden, while they create habitat for birds and animals.

## SHAPE, FORM AND COLOR

Shape and form are as important as size. Consider planting two or three trees of the same family together. Study the surface texture shape and size of foliage. The leaves of palms create a towering sense of architecture. Flowers have a fleeting but memorable presence. Whether they are pale blossoms against dark foliage or dark and colorful, think about how you can set them off best. Fruits and pods bark and branches can either work together or rival one another.



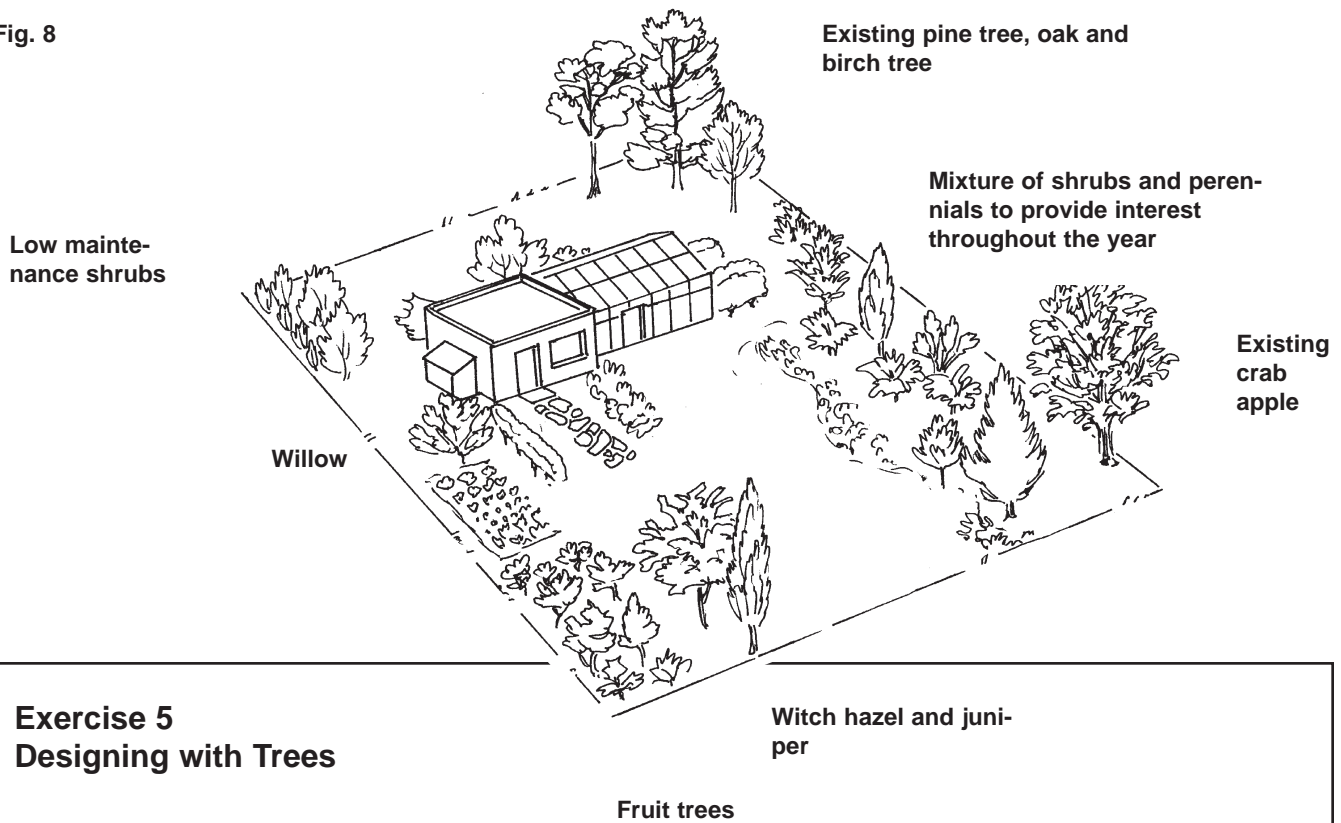
**Fig. 7. Tree shapes and forms together with tree height are some of the main considerations when designing with trees.**

- a. Round: White oak
- b. Oval: Sugar maple
- c. Column: Poplar
- d. V-shaped: Hackberry
- e. Pyramidal: River oak

**Fig. 8. In a large garden or along a roadside or street the architectural nature of trees can be utilized to give structure. Trees may be grouped together to create a strong impact like they might have in the broader external landscape.**



Fig. 8



## Exercise 5 Designing with Trees

### Materials:

- \* A good tree book
- \* Notebook and pencils
- \* The site map already developed in an earlier exercise
- \* Tree catalogs and lists of local nurseries.

### Procedure:

- \* Research trees native to your zone; learn about their height, shape, and soil preferences.
- \* Research catalogs to compile a list of available appropriate trees.
- \* Call local nurseries to request donations of old or overgrown stock.
- \* Contact local forestry service to learn about tree giveaways.
- \* Once you have compiled a list appropriate trees, and have identified a source of donations or inexpensive, trees begin to lay out your garden plan.
- \* Consider height: tall trees need special consideration, small trees need to be carefully planted to make sure they are not lost.
- \* Consider using trees that provide either seeds or fruit for habitat.
- \* Make many designs and try to include as many tree features and considerations mentioned in the bird and butterfly gardening sections as you can when you plan where trees will go.
- \* Sketch out your ideas in a notebook. choose the best ones and create one comprehensive drawing.



## **Profile on the Tree Corps**

Planting and maintaining street trees is one way for released inmates from the San Bruno County Jail to earn a living while improving the quality of life for San Francisco residents. The Tree Corps was the brainchild of Cathrine Sneed, Founder of the city-based Garden Project, a program that builds on horticulture, farming and nutrition to keep ex-offender from returning to jail. Ms. Sneed saw an opportunity to provide former inmates with tree work during her stint with the Citizens Advisory Tree Commission. Money set aside for transportation initiatives was slated for landscaping and planting trees on transportation land. And in 1992, The Tree Corps began when Sneed's gardening group was offered a contract to plant 800 trees.

The following year the SF Department of Public Works extended the contract to plant additional as well as maintain them for a period of 2 to 3 years. The agency also threw in four DPW trucks, and with 10 former inmates, the program was off and running. Corps members are paid an hourly wage of 11 dollars along with health benefits and work closely with a counselor to address other issues in their life from drug abuse to housing to obtaining their GED.

Today the program employs up to 40 people a year and helps them move on to other avenues of school and employment. Charlotte M. may not be typical of all Tree Corps members but offers a glimpse of the change in people's lives that hard work can bring. Charlotte was a long time drug dealer. She was illiterate and a single mother and after her release from jail, showed little interest in finding work. Initially she hooked up with Sneed at the Garden Project's San Bruno County Jail garden growing vegetables and herbs. She then joined The Tree Corps, and its focus on work and school gave her the impetus to learn to read and write. She began to channel her energy into productive work and improving her life. She left Trees Corps and started her own business – a day care center. She bought a house and has lived the past few years as a successful small business-woman.

Other former Tree Corps members are now fulltime employees at DPW or have gone on to retail sales and business.

"Life is good when you set goals," says Lance T. a current Tree Corps member and former drug dealer. "Now when I'm outside I'm planting trees or passing out vegetables instead of looking out over my shoulder."

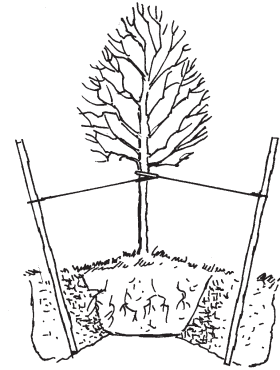
For more information call Project Director Elliot Donnely at Tree Corps the Garden Project

## Exercise 6

### Fifteen steps for planting a tree in ball-and-burlap

#### Procedure:

- \* The root should be watered to prevent the roots from drying out .
- \* The hole should be twice as wide as the root ball and just as deep.
- \* Check the drainage of the soil and hole (make sure there isn't an underlying hard pan) by filling half the hole with water and letting it drain. After several hours if there's standing water, it generally means the site has poorly-drained soil, which could lead to root rot with early over-watering. These conditions may call for enlarging the size of the hole and filling it with loose amended soil, or, if there's a hard pan piercing it with a pick, or planting more shallow-rooted smaller species.
- \* The top of the root ball should be several inches above the soil line to account for settling later on. Should it settle and form a depression, water could collect and cause root or crown rot.
- \* Position the tree and straighten it, be sure the best side is oriented to the direction most desired.
- \* Remove the twine around the trunk and the top of the root ball, and if the branches are tied or wrapped it is equally important to release them before the tree is planted. (That foresight will prevent one from having to unwrap branches when they're high off the ground.)
- \* Cut away the burlap or fold it from the top of the rootball. The burlap, if left near the ground surface, will act as a wick, drawing water away from the roots to the surface. Wire can be cut and folded down and pressed against the bottom of the hole, eventually rusting away. Anything synthetic that can wrap around the roots should be discarded.
- \* Prune dead or dried roots to promote new growth and spread encircling roots to encourage their movement into the soil.
- \* Place stakes which will support the tree in its initial years outside the diameter of the root ball.
- \* Backfill the hole. It is no longer recommended that soil amendments – such as peatmoss, manure or compost – be added to the hole in order to give the developing roots the impetus to spread out into the surrounding soil for nutrients and water. Amendments can be added as a surface dressing later.
- \* Press firmly all around the planted root ball without compacting the soil (if it's clay). This removes air pockets which can dry out the fine roots and kill the plant.
- \* Using leftover fill, form a basin around the hole which will capture water to effectively soak the roots when it's watered. Apply a mulch 2 to 3 inches deep around the basin. The mulch retains moisture, cools the roots, reduces weeds, slowly releases nutrients to the soil, cushions the soil from compaction and is pleasing aesthetically. Mulch should not touch the tree stem ( it can harbor damaging vermin or fungus).
- \* Fasten the stakes. Do not use material that can cut into the tree (wide rubber tied loosely in a figure eight configuration is preferable).
- \* Water thoroughly. A newly planted tree should receive at 20 gallons of water per week during hot summer months. As the tree matures it will require less watering as its roots develop and become more efficient in absorbing water on their own.
- \* Cut away dead branches or twigs.



**Fig. 9. The traditional way to plant a tree**

## THE NURSERY

The establishment of a prison nursery is a brilliant way to create a source of planting materials that can be used at the facility or distributed to different groups in the community. The nursery can include planted stock, propagated cuttings in different stages of growth or full-grown shrubs, trees and perennials that are donated by nurseries or gardens.

At Rikers Island, the Greenhouse Project has developed relationships with a number of different nurseries in Westchester County and Long Island. In late fall, after planting season, the nurseries donate all their unwanted nursery stock to the Rikers program. Materials are heeled into a 50 by 50-foot area mulched and left all winter to the spring. Perennials, trees and shrubs are then planted around the island's different facilities or used for landscaping public spaces in New York City. Afterwards, the nursery is dug in and turned into a vegetable bed for the summer and fall. By November, when the city's nurseries are closing shop, the site is again prepared to receive the year's leftover planting stock.

For the Department of Correction, the nursery is a win-win situation. Not only does it provide free materials to the jail, but it generates a valuable service for nearby communities. Many plants that are badly damaged when they arrive will respond well with proper care and maintenance. An irrigation system should be constructed – aerial if the plants are still containerized – to provide badly needed moisture in the fall and spring.

A curriculum can be tailored specifically for establishing productive nurseries, including topics such as propagation (cuttings), plant classification, integrated pest management, pruning, root care, fertilizing, watering and transplanting. Marketing and pricing can also be included, giving students a full-scale experience in running a nursery. Have plenty of catalogues on hand to help students price out retail and wholesale figures for determining their inventory's overall value.



**Fig. 10.** When The Horticultural Society of New York's Greenhouse Program at Rikers Island recieved a large donation of trees and shrubs from Rockafeller Center in November 1999, the students heeled in about 40 square feet of evergreen. This was about half of the total donation; some trees were 10 feet tall. The rest were planted immediately at the jailhouse in several of the gardens around the island. The trees and shrubs in the nursery later found their way to libraries around the city.

At one point the nursery included donations of roses, euonomous, juniper and honeysuckle and boxwood from two commercial nurseries as well.

## **Growing Trees in Jail – Santa Rosa, California**

At first glance, the fields adjacent to the North County Detention Facility in Santa Rosa California seem to be sprouting branches. A closer look reveals rows and rows of container size trees that will one day supply San Francisco and other Northern California towns with street trees. The program, a unique partnership between the Sheriff's Department, Sonoma County ReLeaf, and the National Tree Trust, puts male inmates to work growing and nurturing over twenty different varieties of trees – from seedlings to full planting size. The trees are then given, free of charge, to schools, county municipal agencies, and non-profit groups as long as they are planted in parks, schools or other public spaces.

The program began when Rick Stern, an agriculture instructor at the facility, decided to establish a "tree growing-out station" in Sonoma County. He contacted the National Tree Trust which agreed to supply trees and funding, while Sonoma ReLeaf, a local non-profit signed on to help coordinate the program and provide financial management and tree planting services.

In 1996 the program was officially underway with the arrival of the first batch of seedlings. Today that number has grown considerably, sometimes reaching 15,000 trees that are available for the taking. Stern is a believer in variety, offering coastal redwoods, valley oaks, maples, redbud, sequoia, and others.

According to Stern, "Everybody wins" with the program. "It gives the inmates a chance to learn responsibility and good job skills," says Stern. "The county gets a source of free, healthy trees –and it benefits the environment."

For more information contact:  
Rick Stern (707) 525-8310



## Chapter 9: The Bird Garden

### BIRD -- A SYMBOL OF FREEDOM

**B**irds, not limited to the high walls and barbed wire of the prison environment, are a natural product of a well-thought, well-built “natural garden.” Their activities, sounds and color are a source of life that adds a new dimension and value to the inmates’ gardening experience. With the right selection of plants for food and cover, prison gardens can provide important habitat to a landscape that is quickly disappearing in the U.S. – meadows, marshlands and young forests which have given way to suburban development. Even in heavily landscaped areas and homes, plant choices tend to favor hybridized shrubs and flowers that provide large blooms at the expense of edible fruit (hybridized plants tend to be sterile), not to mention the replacement of meadow grasses with sterile lawns.

*“Growing plants and trees that provide food and cover is a requisite strategy for attracting birds to the prison garden. While the landscapes inside most prison grounds tend to be spare, small evergreen shrubs and hedges can be a major source of cover for nesting birds.”*



#### Exercise 10

**Identifying appropriate food sources for birds in your home range.**

**Remember that not only nectar and seed bearing plants and trees should be cultivated, but also plants that support insects that birds in your home range feed upon. This includes trees, shrubs and weeds.**

#### Materials:

- \* A good bird book
- \* Notebook
- \* Plant, weed, tree and shrub guide appropriate to your home range

#### Procedure:

- \* Observe birds that visit your site.
- \* Research them with a good bird book and keep a record in your note book.
- \* Research and list the plants, trees and shrubs they favor as food sources; remember to research plants that support the kinds of insects your bird population likes to feed on as well – birds are important predators and can be valuable allies in your war against destructive insects.
- \* Save this list as you will need it to lay out your bird garden.

Growing plants and trees that provide food and cover is a requisite strategy for attracting birds to the prison garden. While the landscapes inside most prison grounds tend to be spare, small evergreen shrubs and hedges can be a major source of cover for nesting birds. Native species should be used at any given chance, including varieties of Ilex spp., Viburnum spp., Amelanchier spp., Juniperus spp., and Prunus spp. Climbing vines such as species of grape and virginia creeper are important food for birds, while the garden's overall diversity provides a wealth of protein in the myriad insects which harbor in the long lived perennials and ornamental grasses.

Often red, nectar-bearing flowers such as cardinal flower (lobelia spp, red sage salvia coccinea, and trumpet vines, are a source of food for the delicate hummingbird. cardinals, finches, mockingbirds and blue jays are colorful residents of urban gardens and are a continuous presence in the gardens at Rikers. Plant lists that attract and sustain birds through the year are available in a number of books for specific zones and regions. Stokes Bird Gardening Book for example is an authoritative guide for establishing gardens that attract birds in temperate northeast regions.

**Favorite weeds, grasses, shrubs, trees, water plants and flowers for bird gardening**

source: Stokes Bird Gardening Book, by Donald and Lillian Stokes; Little, Brown and Company 1998

**Annual weeds**

Filarees (Erodium)  
Goosefoot (Chenopodium)  
Jewelweed (Imapatiens)  
Pigweed (Amarantius)  
Ragweed (Ambrosia)  
Smartweed (Polygonum)

**Perennial weeds**

Dandelion (Taraxacum)  
Pokeweed (Phytolacca americana)

**Biennial weeds**

Thistle (Circium)

**Grasses**

Foxtails (Bristlegrass) (Setaria)  
Panic grasses (Panicum)  
Crab grasses (Digitaria)  
Sedges (Carex)

**Water Plants**

Bulrushes (Scirpus)  
Smartweeds (Polygonum)  
Cattails (Thyphus)  
Pondweeds  
(Potamogeton spp.)  
Widgeongrass  
(Ruppia maritima)

**Shrubs for seed or pollen (Increasing the number of plants that support insects improves habitat for birds. )**

Pycantha coccinea  
Cotoneaster frigida  
Viburnum  
Mahonia

**Trees**

Poplar  
Alder  
Hawthorn  
Downy Birch  
Silver Birch (essential to woodpeckers)

**Flowers for Nectar or seed**

Basil ( Ocimum Basilicum)  
Blue Flag Pant  
Burr Reed  
(Sparganuim Simplex)  
Christmas Rose  
(Helleborus Niger)  
Corncackle  
(Agrostema Githago)  
Crocus Sativus (Saffron)  
Evening Primrose  
(Oenathesa Biennis)  
Golden Rod  
(Soladego Canadensis)  
Globe Thistle (Echinaps Ritro)  
Hedgewoundwort  
(Stachys Sylastica)  
Oriental Poppy  
(Papaver Orientale)  
Wild Strawberries

**One of our favorite bird gardening books**

**Stokes Bird Gardening Book:**

**The complete guide to creating a bird friendly habitat in your back-yard**

**by Donald and Lillian Stokes**

**Little Brown and Company, 1998**

This informative book of discovery will help you create a garden that is naturally attractive to birds. There is a lot of useful information about trees, shrubs, flowers, vines and other landscape elements that birds need for food shelter and breeding. There are beautiful color illustrations of birds that will help you to identify local birds, as well as charts for every region of North America. You'll learn to attract birds with the right trees and plants. Ponds, pools and birdhouses are also discussed.



Fig. 7. Though some native plants, trees and shrubs are considered to be weeds they actually provide good bird habitat.

#### Water Plants

- a. Bullrushes (Scirpus)
- b. Cattails (Thyphus)
- c. Pondweed (Potamogeton)
- Biennials
- d. Foxtails Bristlegrass (Setaria)
- e. Panicgrass (Panicum)
- f. Crabgrass (Digitaria)
- Perennials
- g. Dandelion (Taraxacum)
- h. Pokeweed (Phytolacca Americana)

#### Annuals

- i. Jewelweed (Impatiens)
- j. Ragweed (Ambrosia)
- k. Smartweed (Polygonatum)
- Trees
- l. Alder
- m. Silver Birch
- Shrubs
- n. Cotoncuster Pryacnatha
- o. Viburnum
- Flowers
- o. Blue Flag Plant

- p. Burr Reed (Sparganium Smplex)
- r. Corncackle (Agrostema Githago)
- s. Crocus Sativus (Saffron)
- t. Oriental Poppy (Papaner Orientale)
- u. Wild Strawberries (Frageria Vesca)
- v. Globe Thistle (Echinaps Ritro)

## **Robert Stroud: The Birdman of Alcatraz**

In 1909, at the age of 19, Robert Stroud was sentenced to 12 years for killing a man who assaulted his girlfriend. After stabbing another inmate during a fight, Stroud was transferred to the notorious Leavenworth Prison for hard time. During a meal, Stroud had an altercation with a rookie guard, and as the officer raised his nightstick, the inmate plunged a knife into his chest. The guard died and Stroud was sentenced to die. President Wilson commuted his sentence to life imprisonment after Stroud's mother intervened on his behalf. The prisoner was expected to spend the entirety of his term in solitary confinement .

One day while walking in the solitary confinement yard, Stroud came upon a sparrow, apparently injured, fluttering on the concrete. He took it back with him to his cell and nursed it to health. Stroud observed its behavior, gained its trust and taught it tricks. Eventually he asked the warden if he could keep a few canaries, and was granted permission. Stroud successfully mated his birds, and, despite a third grade education, began to read complex texts on ornithology. He built 30 cages out of bits of scrap he collected in the prison and acquired a microscope, a microtome, test tubes, and bottles of reagents. He began conducting experiments on as many as 300 birds, feeding and caring for them, taking notes about their health, learning about their diseases and autopsying the dead.

Stroud wrote two authoritative books on bird disease and became well known to ornithologists around the country – a number of who became supporters of his bid to win release from prison. In 1942, however, Stroud was abruptly taken out of Leavenworth in leg irons and handcuffs and removed to Alcatraz (meaning ironically “the Isle of Pelicans”). His cages and birds and laboratory equipment was disassembled, boxed in crates and sent to his brother. Failing in health, he began work on a history of the federal prison system called “Looking Inward.” After several hundred pages, the authorities to prevent its publication and confiscated the manuscript.

In 1958, Thomas E. Gaddis wrote *the Birdman of Alcatraz*. By then Stroud had spent 52 years in prison, 46 in solitary confinement. At the age of 69 he was removed from Alcatraz and sent to a prison hospital in Missouri. In 1962, his life story became a motion picture starring Burt Lancaster. Stroud died shortly afterwards. He was 73 years old.

## **WHY BUILD BIRDHOUSES?**

Birds provide us with joy through their songs and beauty; they teach us many lessons about ecology through their complex customs and habits, and they perform many important tasks in the garden. Building birdhouses is one way to keep the birds around us and to thank them for the happiness they bring.

Building birdhouses is also a very good way to practice the skills of planning, observing and building, with all the rewards that these activities bring. There are few activities more rewarding than working nature's materials with your hands. When you plan your birdhouse you are a dreamer who transforms imagination through the medium of wood and tools into the solid matter of a tangible useful and beautiful structure. There are many books that tell you how to build birdhouses, but with a personal vision, you can make a creation of your heart that is also a shelter for the birds who dwell in your garden.

The most basic woodworking skills will take you a long way, which is in fact true about many garden construction projects discussed later on in this book. Care, observation, thought and a sense of fun will take you as far many times as the most well-equipped carpenter's shop.

In our own work up until recently, we have used hand tools almost exclusively.



Consider the opportunity for cooperative projects with schools and daycare centers. Recently we began a project to provide birdhouse kits to a landless school in East Harlem along with planter boxes for their rooftop garden ecology center. Although plans for birdhouses are plentiful, we chose to design our own style based on sketches from a variety of sources. If you feel it in your heart, the final result will be just fine.

Wrens prefer a 1-inch entrance to their birdhouse; hang the house from a branch of a fruit tree 5 to 10 feet above the ground. Bluebirds prefer a house with a 1 3/8-inch hole. Mount their house on a post 4 to 6 feet above the ground. Robins and swallows prefer a roofless nesting shelf mounted 6 to 10 feet above the ground. With the help of a good birdhouse book, you can create a table like the one below to help you design a safe and comfortable bird house. In the absence of big old trees, birdhouses can provide habitat for nesting for many species.

No matter what kind of birdhouse you dream of making, you must start with observation of the kind of birds in your home range followed by research on the specific needs of each family. There are lots of books out there that can provide you with information about the sizes and dimensions most appropriate to those birds who will nest in built houses. Try making a table like the one below as a start.

To offset the hardships of winter, and to attract year-round residents, feeder boxes are a necessary addition to the prison landscape. Inmates should be encouraged to document the different species of birds visiting the feeders. This activity mirrors "Feeder Watch", a program established and run by the National Audubon Society, which encourages homeowners, schools and different institutions to track and monitor bird populations from feeders in their backyards. Instructors can involve their prison gardens with Feeder Watch and contribute data to the nationwide tracking program by simply writing to the Audubon Society in New York and requesting a Feeder Watch packet. And finally, for the summer, a birdbath or water pond is another requisite for attracting birds either nesting in the garden or simply visiting from beyond the prison walls.

<b>Birdhouse sizing guide</b>				
	<b>Nesting Area width, depth, Height: in inches</b>	<b>Entrance Size Height above floor to center of hole: in inches</b>	<b>Mounting height: in feet</b>	<b>Preferred food</b>
<b>Bluebird</b>	5x5x8-12	1-1/2, 6-10	4-6	Berries insects
<b>Chickadee</b>	4x4x8-10	1-1/8, 6-8	4-15	Seeds, berries insects sunflower
<b>Titmouse</b>	4x4x10-12	1-1/4, 6-10	5-15	Insects berries seeds sunflower
<b>Wood Duck</b>	10x18x10-24	4, 12-16	10-20	water plants minnows frogs
<b>Woodpecker, downy</b>	4x4x8-10	1-1/4, 6-8	5-15	Sunflower insects
<b>Wren, House</b>	4x4x6-8	1-1/4, 4-6	5-10	Insects

Source: How to Build Collectible Birdhouses, David Kephart, Radnor Hill Publishing Inc. Philadelphia, 1995



### Exercise 11

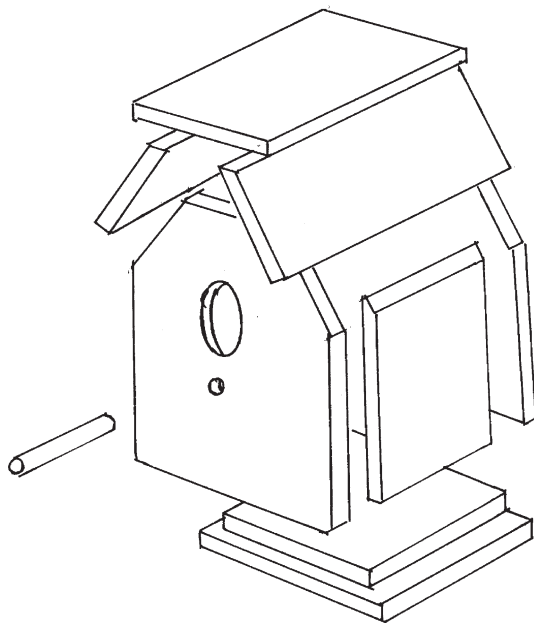
**Designing birdhouses.** Keep in mind that though there are many good books of bird house design, the best alternative for you may be to design your own!

#### Materials:

- \* A good book of birdhouse construction that includes a birdhouse sizing guide
- \* Notebook, pencil, ruler

#### Procedure:

- \* Prepare a sizing guide like the one above that contains information about the kinds of birds you have already observed in your area, or that you would like to attract.
- \* You can make a simple design like the one pictured or you may decide to make one based on a structure you feel inspired by like a church, or gas station. Just make sure the dimensions conform to your sizing guide.
- \* Later in this book we will describe methods of construction appropriate for bird houses.



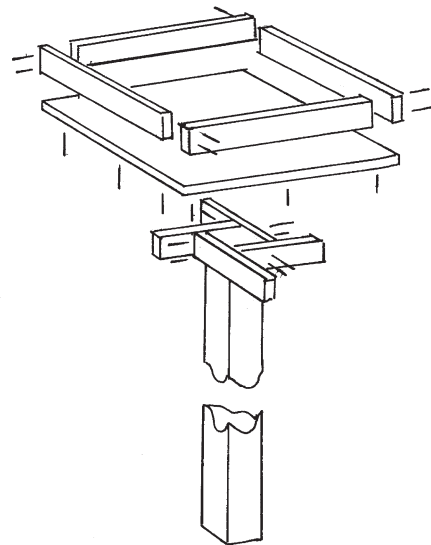
### A favorite birdhouse books

#### How to Build Collectable Bird Houses

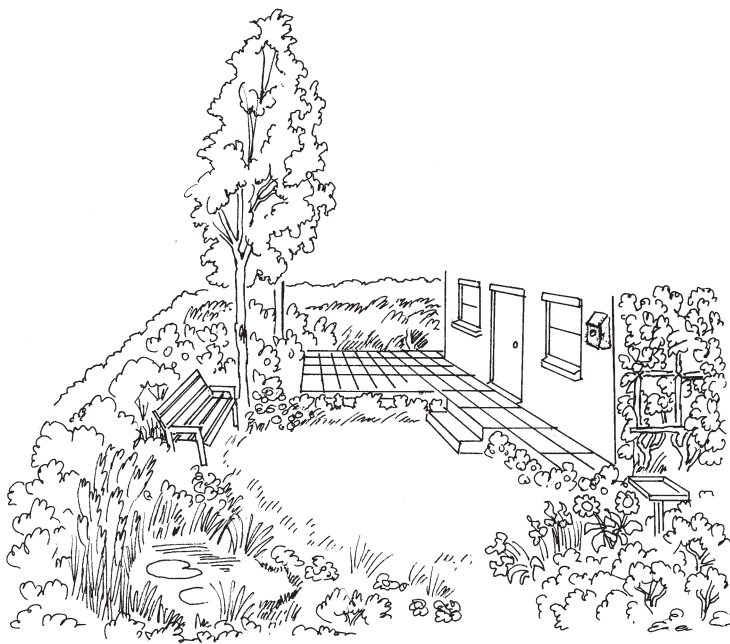
David Kephart  
Radnor Hill Publishing Inc.,  
Philadelphia, 1995

David Kephart's book shows you step-by-step how to make birdhouses that are collectable as folk art and safe and comfortable for birds. Designs include simple bird houses to ones that imitate many structures including country churches and mobile homes. This book gives plans and material lists. It emphasizes the importance of careful construction techniques and attention to detail.

For those who prefer, there is a discussion of how to make your own birdhouse design based on photos and sketches. All tools needed are described. Most importantly there is a birdhouse sizing guide that analyzes the housing needs of 22 species of birdhouse dwellers.



**Fig. 8.** Birdhouses and birdfeeders are fun and easy to make. Here are two designs that our students came up with. Use your imagination and have fun. The important thing to remember is that no matter what style you fancy be sure to observe the specific space needs of the birds in your home range.



## PUTTING IT ALL TOGETHER

Even a small garden has plenty of room for you and a wide range of insects, animals, and birds. Some of our gardens were developed on the theme of a woodland glade. Woodland edge, wildflower meadow, garden pond and feeding station can all interlock in a relatively small space. Features such as ivy against the wall shelter nesting birds. Rotting logs provide habitat for toads and bird nesting houses make up for a lack of big old trees. No room for a pond? Even a birdbath can become a real center for bird communities.

**Fig. 9.** Many features discussed in this chapter can be combined in even a small area to create a safe and comfortable habitat for birds.

### Exercise 12

**Designing your bird garden. Keep in mind that birds love cozy corners. Even a small area close by your classroom is fine with many birds. Use birdhouses if you lack big old trees.**

#### Materials:

- \* Paper, pencils, ruler
- \* Wildlife garden book
- \* List of appropriate plants, trees, shrubs and vines created already

#### Proceduer:

- \* Study your list of plants, shrubs and trees that either support insects preferred by local birds or that support birds directly with their seed or fruit.
- \* Create a design for a 40x40 ft area based on your knowledge of bird habitats by:
  1. Making use of out-of-the way corners of your garden (these may be quite close to your classroom or work area.)
  2. Use as many features described in this section as possible, including a pond and water plants, bird and bat houses, bird feeders, trees, shrubs, annuals, perennials and weeds.
  3. Pay attention to such considerations as the height and color of the plants you choose when arranging the layout.
  - 4 Be sure to create cozy corners where birds can nest. Spaces behind vines, copses of small trees, and hedges and shrubs are favorite bird habitats.
  5. Consider recreating woodland, desert or meadow terrains according to the landscape features of your home range.
- \* Discuss the possible merits of several designs, and combine or select to create a comprehensive plan.

### **Exercise 13**

**Making pine cone garland bird feeders.** Winter is a difficult time for birds. If you live in an area that experiences severe winters you can support your bird population with these simple, fun and elegant activities.

#### **Materials I (pine cone bird feeder):**

- \* Pine cones (as many as possible)
- \* Floral wire
- \* Crisco shortening or peanut butter
- \* Sunflower seed and cracked corn
- \* Other seeds from local bird habitat flowers that you have already researched

#### **Procedure:**

- \* Roll the pine cones in crisco
- \* Mix all the seeds and nuts together
- \* Roll the pine cones again in the seed and nut mixture
- \* Wire the pine cones to branches of trees where birds socialize
- \* Repeat when all food is eaten

#### **Materials II (garland bird feeders)**

- \* Cranberries, raisins, peanuts w/shells on, sunflower seeds w/shells, dried apples, crabapples and other fruit collected in fall
- \* Dental floss (five foot sections)
- \* Needles (large eyed) — one per student

#### **Procedure:**

- \* String all the food in alternating sequences.
- \* Hang the garlands from trees where birds socialize
- \* When the garlands are all eaten up, make new ones.

# Chapter 10: Implementing the Plan and the case of Kauai County Correctional Center

*The voice of Nature loudly cries,  
And many a message from the skies,  
That something in us never dies.*

***“Truthfulness and self-realization are the core issues that everyone encounters every day; you can choose to ignore these issues, but that won’t make them go away. This is what I say when I go to the high school and talk to the students.”***

Sean Breen - inmate

## INSTALLATION: MARKING YOUR GROUND

Once the use for the site has been selected and a design is ready to be implemented (see chapter 5 for landscape design) there are a number of steps to consider before planting. The following guidelines for implementing your plan can be part of any garden curriculum.

- \* Mark off the area of the bed with stakes and twine.

- \* For large areas, a rototiller or plow may be recommended to cut the beds. Remove grass clumps. Sift rocks as much as possible, storing large ones for later use in the garden. Level the area with a heavy metal rake – this will break up small clods—and then go over with a leaf or fine-tooth rake to smooth out bumps and remove remaining weeds and roots from the surface to give a nice finished look.

- \* Check the soil pH and soil texture and add amendments if the soil needs improving. For large beds, concentrate amendments near the areas to be planted.

- \* Cover soil with a dark plastic that will kill emerging weeds, and prevent airborne seeds from seeding in (even clear plastic will suffice for the short-term.)

- \* Edge out a trough along the border to prevent grass from encroaching on the bed.

- \* Ensure the appropriate spacing for perennials and annuals (see insert).

- \* Mark off seeded areas or areas with small plants that could be mistaken for weeds with stakes and twine. This will prevent students from inadvertently walking on planted beds or removing plants they think are weeds. (This happens more than we care to admit).

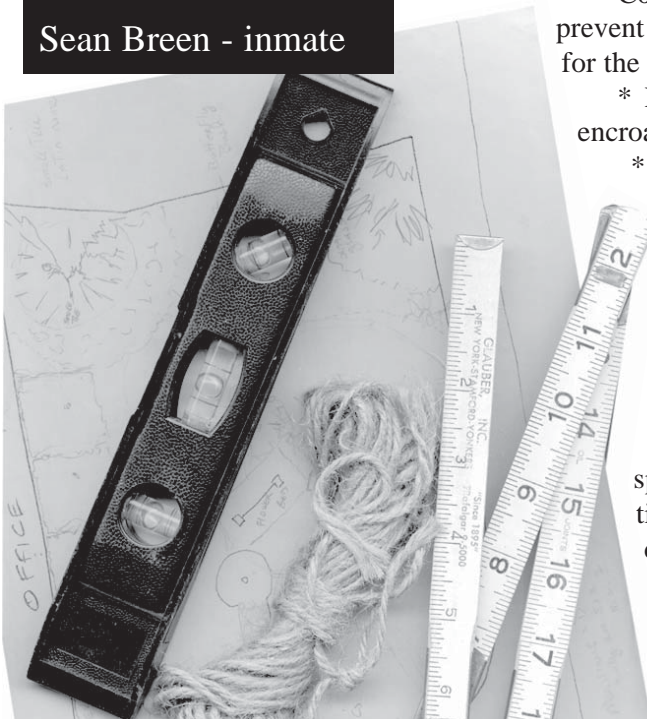
- \* Label plants or seeded areas.

- \* Arrange trees and shrubs in their designated planting space. Have students imagine the actual growth and maturation of the plant. Are they spaced apart far enough? Do not dig the holes or remove them from their pots or burlap. Does the arrangement produce the desired effect? Now is the time to make changes.

- \* It’s time to plant. Watch for air pockets.

- \* Mulch the bed.

- \* And don’t forget to water.



## Exercise 1

### Marking off the ground

#### Materials:

- \* Any of the site plans you created on 1/4 inch graph paper using the exercises in Chapter 5.
- \* Extra long measuring tape
- \* Stakes
- \* String
- \* Hammer
- \* Calculator, notebook, pencil

#### Procedure:

- \* Starting from a fixed point on your site plan such as an existing tree or corner of a building, count the number of boxes on your graph paper and convert them by whatever scale you chose when making your drawing to actual measurements. Always use a ruler when measuring diagonally across boxes on your graph paper because the measurement from corner to corner of a box of graph paper is longer than the measurement of a side. For example: if two 1/4 in boxes on your graph paper equal 1 foot at your site, then the scale is 1 to 24. Using the scale 1 to 24, if a diagonal line down from point **a** to point **b** measures 9 1/4" on your graph paper, then it's conversion to feet is equal to 19' at your site.
- \* Starting from the actual fixed point on your site, use your extra-long tape measure the distance to the first point (usually a boundary point) in your garden.
- \* Drive a stake in at this point.
- \* Now measure a series of triangles based upon your established scale. Always start with your fixed point and using the last point staked out as the second corner of the triangle, plot out the new point as the third corner of the triangle.
- \* Use this procedure to pinpoint the main features of your garden.
- \* Drive stakes in at the boundaries of each of these main features.
- \* Connect the stakes you have driven into the main points by string to demarcate the boundaries of your beds and important features such as paths.

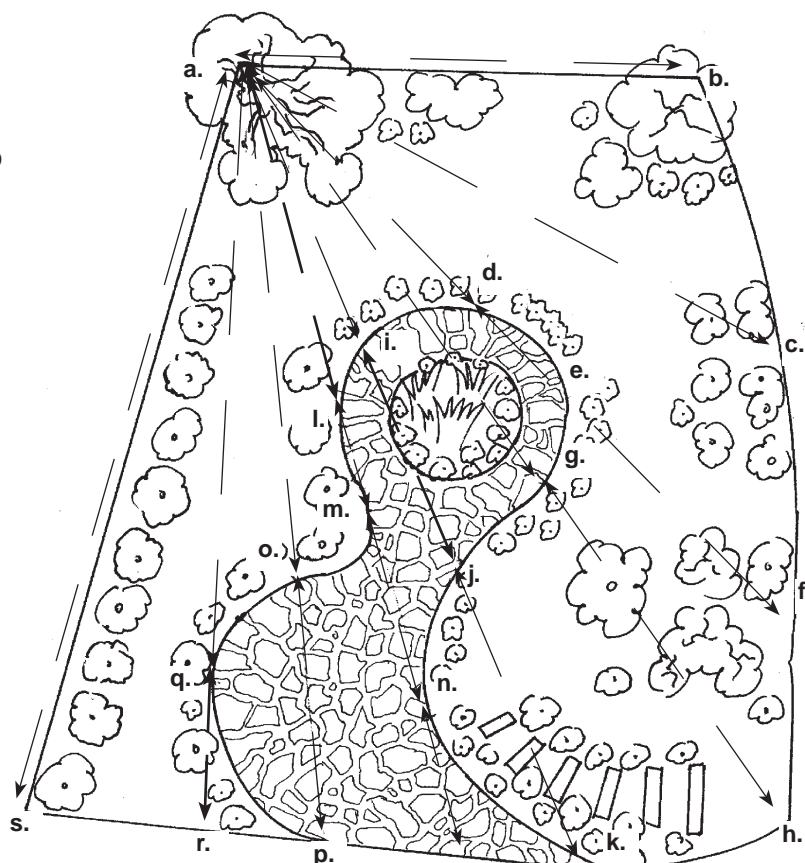


Fig. 1. Site sketch on 1/4" graph paper. By measuring with the use of triangles, you are always assured of knowing the distance to a point of reference. First measure from **a** to **b**; then plot the point where **a.c.** and **b.c.** meet. Always start to measure from the fixed point **a**.



## Exercise 2

### Creating paths and preparing the beds

#### Materials:

- \* Dark plastic or landscape fabric (clear plastic can be used if necessary.)
- \* Crushed stone, pebbles, bricks or other path material
- \* 2"x4" boards, plastic edging or cobble stones
- \* Stakes, hammer, level

#### Procedure:

- \* If your design is to have paths, measure and stake them according to Exercise 1.
- \* Excavate the earth where the paths are to be to a depth of 6".
- \* Edge paths with either cobblestones, wood, or plastic edging (Excavate the earth carefully; if a level surface is desired, use a spirit level to check your work.)
- \* Fill with crushed stone, pebbles, or create a pattern of brick. Creating a pattern of brick is discussed in the chapter entitled "Creating Garden Structures."
- \* A layer of plastic can be put down first to prevent weeds from sprouting between the paving.
- \* Once the soil in beds has been conditioned with topsoil and or sand and compost according to the needs of your plants, and the condition of your garden soil, cover the earth with dark plastic until you are ready to plant.

#### Converting from inches to feet

Implement the procedure in Exercise 1 in reverse to plot your actual site based on a scale drawing. Return to your fixed point **a**, in this case a large existing tree. Carefully measure the distance from **a** to each consecutive point. Keep in mind that your scale in this example is 1 to 24 so that 1 inch of your drawing (whether across 4 consecutive graph boxes or measured diagonally with a ruler) will equal 1 foot of true space

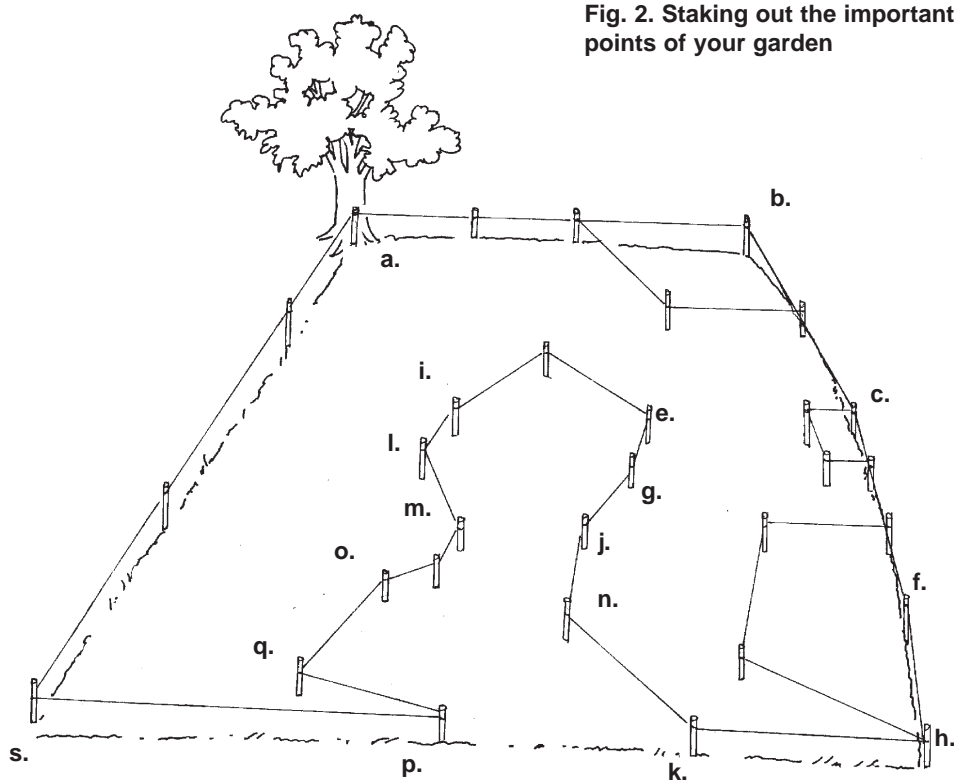


Fig. 2. Staking out the important points of your garden

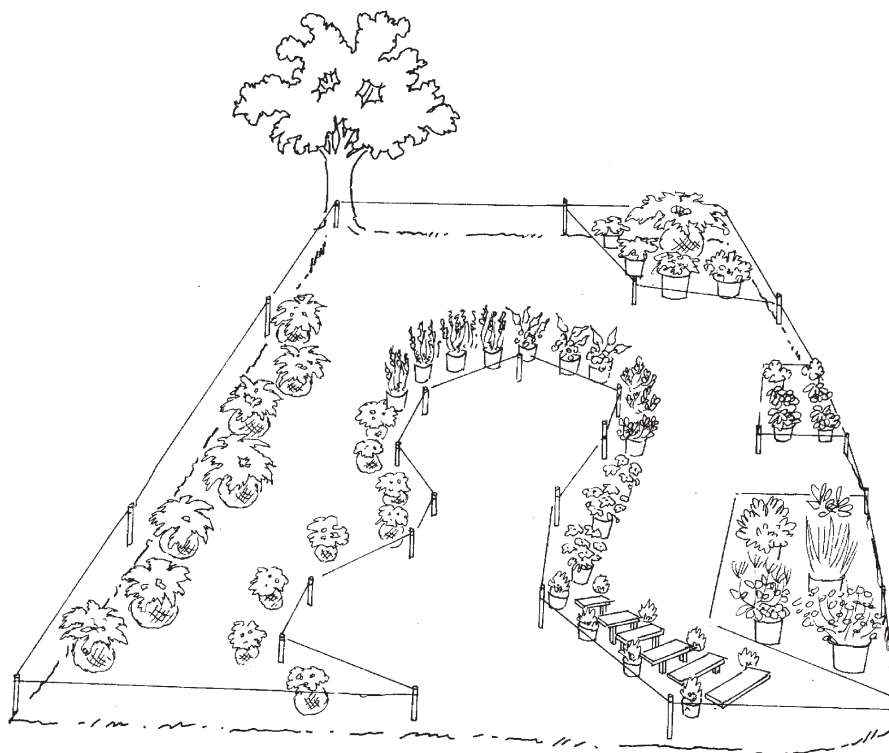


Fig. 3. Once you have marked out the important points of your garden site with stakes and string you can begin to place the plants in the position they will occupy. Don't start to dig any holes until you have placed all the plants still in their containers. The reason for this is that you may want to make alterations based on how the actual site compares to your site plan.

### Exercise 3 Planting

#### Materials:

- \* Your site plan and plant list
- \* Shovels, trowels, hard rakes, mattock
- \* The shrubs, trees, perennials, annuals, seedlings, and seeds you plan to have in your garden
- \* Extra long measuring tape
- \* Graph paper, pencil, calculator

#### Procedure:

- \* Make detail plans of the individual beds using graph paper.
- \* Place your shrubs, trees, and perennials according to the individual bed plans.
- \* Move them around till you are satisfied with the results.
- \* Direct sow seeds where appropriate (refer to the chapter about direct sowing.)
- \* Remember to mark the area where you have directly sown with clear labels so you will be able to remember what you planted in each area.
- \* When you are happy with the arrangement, plant trees, shrubs, perennials, and annuals according to the procedures described in Chapter 5.



**Figs. 4.** Staking out the area. All the important points of this circular herb and vegetable garden were marked out in relation to the fixed starting point at the center of a smaller existing round garden. In this photo you can see the crew has already dug down to a depth of 6" the areas where paths will be.



**Fig.5** In order to assure even drainage the students designing the garden decided to level the beds as much as possible. Here the students are shown placing the edging. 2"x4" boards were added to make the edges more stable. Because the timber was untreated it will have to be replaced eventually. A nearly completed brick path is seen at the lower right corner.



**Fig. 6.** With the paths almost completed and the beds all laid out and soil improved with compost, the students begin to place the plants. Using the formula on the next page, it is possible to determine the optimum number of plants of any kind for each bed.



## Formulas for Estimating Numbers of Plants

Michael Ruggiero of the New York Botanical Garden developed one system that effectively approximates the number of plants that fit into a planting bed. Instructors can use this system as a hands-on lesson in geometry as well.

**Step 1.** Determine the number of square feet in the area to be planted.

- \* For rectangles multiply length x width

- \* For circles multiply the radius of the circle by itself then by  $\pi$  (3.14)

- \* For ovals multiply the average radius by itself then by  $\pi$

- \* For triangles multiply  $1/2$  the height x the base

**Step 2.** Determine the number of square inches in the area to be planted by multiplying the number of square feet x 144 (which is the number of inches in 1 square foot).

**Step 3.** Determine the number of square inches a mature plant will cover. (This can be accomplished by multiplying the suggested spacing between plants by itself).

**Step 4.** Divide the number of square inches required for one plant into the number of square inches in the plot. The answer will be the total number of plants needed for that plot.



Fig. 7. The gazebo garden before planting.



Fig. 8. The gazebo garden after planting. Certain spacing issues could not be addressed until the donated plants were in our nursery. Other plants were raised in the greenhouse, and on occasion it was even possible to purchase particular plants.

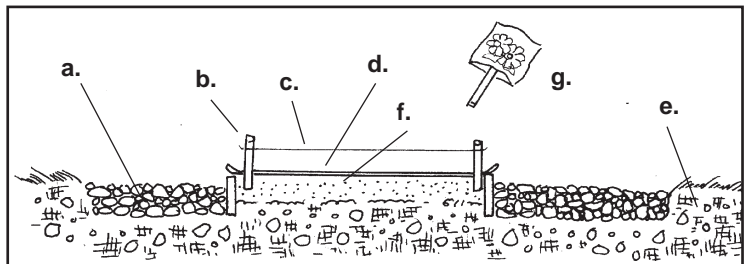


Fig. 9. Cross section of beds and paths. a. gravel or crushed stone path. b. stake. c. string. d. dark plastic (to be removed before planting). f. topsoil. g. plant label. e. garden soil.



**fig. 10. Carefully laid out beds of vegetables flourish amidst tropical fruit. at Kauai Community Correctional Center. At KCCC there is an emphasis on Community. The facility itself has no perimeter fence.**

## **THE SELF-SUFFICIENT PRISON FARM**

The Kauai County Correction Center in Hawaii has done more than make horticulture an integral part of its program; it has become the Center's ethos in transforming both the prison grounds and the lives of its male and female inmates.

Located on the island of Kauai, the fourth smallest island in the Hawaiian archipelago, the Center is a state facility, though it also functions as the county jail, housing 150 inmates with sentences that range from several months to over ten years.

As you drive along the Kuhio highway from Kapaa to Lihue, past golf courses and tourist hotels, the facility is on the right on a low grassy area which was once a swamp. Nestled among palm trees surrounded by gardens, ponds and aquaculture tanks, the facility looks more like a tropical farm than a major state facility. A mountain ridge of the volcanic range from which the island is formed rises up behind the compound. There is no perimeter fence and only a simple kiosk manned by one correction officer at the entrance gives any indication of what lies behind the fringe of palm trees. The penalty for crossing the highway without authority is an additional five years tacked onto the individual's sentence.

Kauai's island geography contributes to the open environment of KCCC. The island is just about equidistant from Japan and California, with Siberia the only landmass to the north. There are about 100 miles of treacherous open sea separating Kauai from Oahu, the nearest island of the Hawaiian chain. Most people live within a few miles of the coast, and about one-quarter of the island has been made into a state preserve. There is a single airport at Lihue with links to other islands in Hawaii.

Isolation created a unique ecosystem in this fertile volcanic environment. Since its settlement by non-native people in the 19th Century, a strong tradition of gardening and farming has taken root, and almost everyone today has a vegetable garden and orchard with citrus, avocado and banana trees. Gardens are an important year-round resource on an island where food is expensive as an import from the mainland.



## Lifetime Stand

Approximately half the inmates at KCCC live in lockdown situations. The other half is participating on some level in a horticulture project created by Warden Wagatsuma and his staff called “Lifetime Stand.”

Lifetime Stand employs rules, programs and education to reach goals of retribution, restitution and productivity. Through the program, inmates are encouraged to examine issues about criminality, drugs and family in a way that leads to core self-awareness and potential changes in behavior. The activities and work which Lifetime revolves around are the creation and maintenance of the Center’s self-sufficient food production system – a complex of gardens, orchards and fish-rearing ponds that make up a bulk of the compound’s acreage.

During a recent trip to the Kauai facility, I met with inmates who explained to me Lifetime Stand’s goals and work activities while we sat outside their cabins and toured the ponds and gardens. These men were the senior members of Lifetime Stand. An inmate can only become a member if they pose no security risk. The applicants must also attend a series of interviews and meetings with staff and participants. If they are accepted into the program, they are entitled to move into the cabins – typical old-style Hawaiian farm buildings that might have been found on turn-of-the-century plantations. There are also several modern cement cabins with meeting rooms and a small administrative office. Members cook their own meals in an outdoor kitchen using wholesome food grown at the Center.

Truthfulness and self-realization are the core issues that everyone encounters every day; you can choose to ignore these issues, but that won’t make them go away. This is what I say when I go to the high-school and talk to the students.

*Sean Breen -  
inmate KCCC*

## Beginning with Gardens

Leutenant Lindsey used to order the food for the jail. In 1978, he started a garden as a small-scale vegetable patch to supplement the kitchen food. Slowly he extended plots which he turned over to trusted inmates. After he left the facility the garden was dormant for a time until Correction Officer Perriera took over the program. An island local, Perriera was a member of the Future Farmers of America (FFA), and like almost everyone else in



**Fig. 11. All food used by the members of Lifetime Stand is grown on the compound except the luxury items like fats and soy sauce. This is due in part to the year-round growing season of Kauai.**

### **The twelve “commandments” of the Kauai Community Correctional Center Lifetime Stand**

1. Uphold the principles of the cabin.
2. Be respectful to staff, and each others.
3. Search for what is right.
4. Take part in daily activities to develop discipline and understanding in your mind, body and spirit.
5. Treat others as you want to be treated.
6. Be patient and trust in the process.
7. Be honest with yourself and others.
8. Support the less fortunate without, resentment or self-righteousness.
9. Do not resort to violence in thoughts or actions.
10. Communicate with openness.
11. Do not be afraid or ashamed to reach out for help.
12. Stay strong and focused, even when you leave this home.

Kauai was a backyard farmer. Perriera immediately re-established the gardens and expanded the plots. Today there are five acres that are cultivated for taro, bananas, papayas, gandules, mustard, cabbage, sweet potatoes, tomatoes, eggplants, beans, and herbs. He also constructed a duck pond, built chicken coops and started an aquaculture project raising tilapia.

Each day begins with a military style roll call. Afterwards the work release crews go to their assignments – some leave the grounds to pick coffee at a nearby plantation and others have special community service projects in town—and the gardeners start theirs. Men and women often work together. Though individuals tend plots and nurture the growing number of animals, they can also initiate new projects on the farm as well. An inmate recently designed and installed an irrigation system for several of the larger plots. The aquaculture project was designed by inmate Robert Hama using 10 small swimming-pool-size tanks and implemented with funds provided by the Lili O’Kalani grant. Water from the fish tanks is used to irrigate the taro patch.

Construction of garden structures and improvements to existing structures were evident everywhere. I spoke with an inmate who was propagating and growing flowers in a newly cultivated area. There is no official budget for the horticulture program; rather it is self-sustaining through a blend of local culture and good planning. There is often a surplus of food which the inmates distribute at a local senior citizens’ home.

All Lifetime Stand members have input in the running of the program, but older members have authority over newer participants who must advance through a series of grades to the most trusted positions. The guidelines for Lifetime Stand have been delineated into 12 rules. These rules are stenciled on the wall of the mess. Breaking any one of them can get a member transferred back to the lockdown housing.



**Fig. 12. Though ducks are no longer raised for food, so comfortable did some become that they still remain on the compound and maintain homes in the nests built by the members of Lifetime Stand. So territorial and integrated into the life of KCCC have they become that I was warned not to approach too close or I could be nipped.**

## Holistic Approach

The program at Kauai makes the unique approach of forming a cohesive unit of the crew, while stressing development of the individual. Since almost everyone on the island is familiar with gardening, the program does not supplement the work routine with classroom activities. Education is hands-on in a strict informal manner as a shared body of knowledge among inmates and officers. This is in keeping with the Hawaiian custom of passing on knowledge within a family or community context. The inmate who devised the irrigation system trained other inmates in the installation of the project. These skills are entirely consistent with the type of employment opportunities available in the local economy.

Other cultural beliefs such as “mana,” a spiritual strength derived from the environment, are also examined and utilized as a source of change. Planting provides a quiet meditative component to the mix of military discipline, music and community and work release that is Lifetime Stand.

Sean Breen, my guide and a senior member, believes that planting is a major influence in redirecting his life. “When I plant a seed I am nurturing positive change, otherwise how can I be part of a family or a community if I can’t even look after a plant . . . or when I make compost I think to myself about the mistakes I’ve made and how there is some kind of way I can fertilize my own life with the knowledge I get about myself from examining the truth about my mistakes.”

The emphasis of Lifetime Stand is that change is a lifelong process and if any change is to be truly lasting it requires work and courage.

For more information about Lifetime Stand contact :  
Kauai Community Correction Center  
3-5351 Kuhio Hwy  
Lihue, HI 96766



**fig. 13. The fish farm provides Tilapia for the members of Lifetime Stand. Funding for the project was obtained through a grant from a local foundation. Water from the tanks is used to water the fields.**



# Chapter 11: Sustaining the Garden

*A man of words  
And not of deeds  
Is like a garden  
Full of Weeds.*

***“In gardening, maintenance has all its metaphors and references: It’s one thing to find a job, it’s another thing to hold one.”***

## MAINTENANCE

As the days of spring drift into the heat of summer, much of the outside work will be geared towards simple maintenance. Those of us who grew up with gardens perhaps have early memories of pulling weeds and watering early summer mornings. Not much has changed. Gardens still need weeding and watering, despite the more elaborate irrigation and pre-emergent systems the program can muster. As I like to tell our students, planting is a one-time conception, but maintenance will determine how the garden will look throughout its lifetime. In other words, the best designed, most extensively planted garden will deteriorate in no time into a ramble of weeds, wild shrubs and emergent trees without efforts to control the active force of nature. (There is an exception if the desired outcome is a native restoration project.)

In gardening, maintenance has all its metaphors and references: “It’s one thing to find a job, it’s another thing to hold one.” Maintenance is the same approach to hygiene, exercise, and cleaning one’s house. It can be meditative through simple repetition and the immediacy of positive results. It is also a way to become intimate with the dynamic processes taking place on both a daily and seasonal basis. Maintenance is a time to be observant in the garden. What flowers need deadheading, which emerging plants are weeds, are there insects that are problems, should the shrubs be pruned back or perennials divided? What is the desired look and how to sustain it without curtailing the growth and development of the system? What works in your system and what doesn’t?

Of course, students often think of maintenance work as garden drudgery. But there are programmatic methods that can be effective in taking the edge off maintenance tasks and acclimatize students to the rhythms of nature. Often we like to give each student a section of the grounds to maintain on their own. Eventually they develop an eye for what needs to be done along with the responsibility and desire to complete tasks on a daily basis. We also break up tasks into a series of learning activities that acquaints students with different weeds, their life cycles and potential uses, or strategies in IPM, or plant growth.

NOTE: Much of the available work in landscaping and horticulture is in garden maintenance. In New York City and its environs, knowledgeable gardeners can command up to \$20

an hour and more tending home gardens as private contractors. There are also opportunities to establish more large-scale maintenance operations. Often the companies that work exclusively in maintenance have little horticulture knowledge nor are they practitioners of organic gardening. Environmentally friendly landscaping is in demand these days and homeowners are willing to pay more for these systems (see IPM pg. 12-7.)

Over time, most of our students fall into a relaxed and contemplative mood as they go about their tasks maintaining the Rikers gardens. Productive talks with students or individual counseling sessions typically emerge in this setting; it is an effective and natural way to get students to open up discuss their goals and interests, their fears, and their need for establishing a future away from jail. I have found this far more productive than what transpires in more conventional counseling venues.

So as summer stretches onwards it is important to use simple activities not only as a way to keep the gardens properly maintained, but as a pathway for learning more about ourselves and the natural world around us.

### **Garden maintenance curriculum and job readiness**

- \* Is your program making use of any educational and vocational services available in your community?
- \* Give your students every chance for success by designing a curriculum that addresses an analysis of the job profiles likely to be encountered by participants to your vocational program.
- \* Is your approach based on the kind of opportunities available in your community?
- \* Is it possible to meet regularly with other professionals partners to discuss goals, curriculum, objectives and scope?
- \* Job profiles are available from professional gardening, landscaping and horticultural organizations.
- \* Entry or reentry into the job market can be streamlined by focusing the student's education.
- \* An intensive garden maintenance curriculum can be completed in as little as seven months
- \* Is your curriculum one that may be recognized by professionals?
- \* Enhanced employability is linked to heightened self-esteem.
- \* Resume writing and interview training promote job placement skills.

**Fig 1. By encouraging students to design diverse habitats they will experience a variety of maintenance challenges.**





## WEEDS AND WEEDING

Weeds are often referred to as undesired plants growing where they are not wanted. But weeds are more than that. They are generally persistent and aggressive, establishing deep taproots or underground colonies of rhizomes, or extensive seed heads that carry on the wind. They are generally drought tolerant, can survive in the most inhospitable elements, and are the first to colonize overturned or disturbed sites. Cut a root or leave shreds of roots in the soil. Each one can sprout a new plant, producing an explosion of new plants. Weeds are generally non-native, allowing them to thrive pest free in their new surroundings. Their persistence is often worthy of admiration, yet left undisturbed they will out compete desired plants for sunlight, space, nutrients and water.

Not all weeds are weeds. Some plants considered weeds can take important roles in your planting scheme. Yarrow (*Achillea* spp.) and varieties of coreopsis are flowering plants that do exceptionally well on dry, low maintenance sites. Butterfly and milkweed (*Asclepius* spp.) are becoming eradicated in their native sites, yet provide valuable forage for butterflies and their larvae and should be part of a butterfly garden. At our Rikers site, we even let dogbane hemp flourish as important food and cover. However, dogbane forms an extensive system of rhizomes and left unchecked will spread through your garden like an emergent forest.

### Friend and Foe

Princess or Empress Tree (*Paulownia tomentosa*) -It may be found growing through cracks in the asphalt in Mid-Atlantic cities such as Baltimore, but this fast growing tree is a valued wood in Japan with board feet prices exceeding that of walnut. Poachers are known to harvest paulownia from private properties or parks in the dead of night, selling it to mills for as much as \$10,000 a tree.

**Ailanthus (*Ailanthus altissima*)** – Frederick Law Olmstead imported ailanthus tree from China as a street tree for the cityscapes in New York, Baltimore and Philadelphia. It was the one species he felt could stand the rigors of urban life.

**Norway maple (*Acer platanoides*)** – Introduced from Europe and Eurasia, this maple is the most widely planted street tree in America. Yet its dense shade and huge production of seeds make it a problem when it colonizes city parks and suburban and town landscapes.

**Dandelion (*Taraxacum officinale*)** – The latin name refers to its medicinal value, and it is recognized as such by Europeans since the Romans who widely cultivated the plant in their gardens. Every part of the dandelion can be ingested. New leaves are used in salads, or cooked as a potherb. Flower buds are a substitute for capers, and the blossoms are made into a popular wine. The roots can be ground up and used as a substitute for coffee.

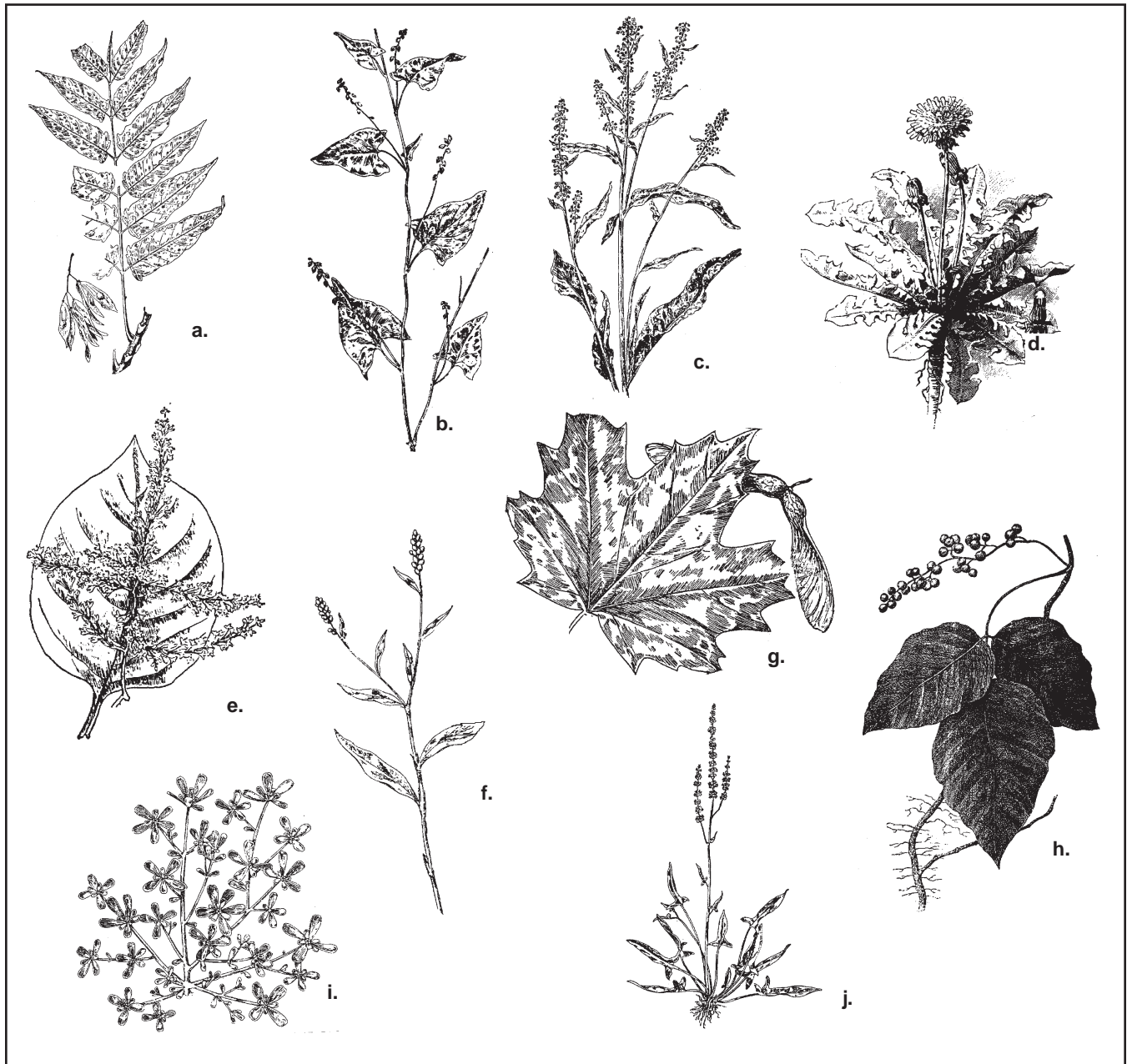
**Melaleuca (*Melaleuca quinquenervia*)** – Introduced as a hardy ornamental tree from Australia for tropical and sub-tropical areas in the U.S. Its attributes – tolerance to fire, flooding and drought, heavy seed production — and the lack of natural predators has allowed this tree to seriously spread, invading and colonizing wetlands at the cost of native vegetation.

**Purslane (*Portulaca oleracea*)** – Of Indian and Eurasian origins, it has been cultivated for thousands of years and was Ghandi's favorite vegetable. It makes an excellent cooked vegetable prepared like spinach yet, unloved by the culinary-challenged, purslane is a constant nuisance in the garden.

Other plants used in the garden as herbs or flowers can naturalize and become an invasive nuisance. Fennel, coreopsis, amaranth, and mint spp. are a few of the more persistent Rikers plants which have done exceedingly well and need controlling. On the other hand the introduced loosestrife (*Lythrum salicaria*), which gardeners used

as a choice perennial since the early 1800s, has escaped its garden confines, becoming an ecological disaster in wetland sites throughout temperate regions of the country.

Other introduced varieties of butterfly bush (*buddleii davidii*), barberry (*berberis* spp.) spirea, *Euonymus fortunei* – all popular ornamentals in temperate gardens — are potentially invasive and have been slowly appearing in natural areas away from the garden.



**Fig. 2. Weeds – Friend and foe.**

a. Ailanthus  
b. Black bindweed.  
c. Curled dock  
d. Dandelion

e. Japanese Knotweed  
f. Lady's Thumb  
g. Norway Maple  
h. Poison Ivy

i. Purslane  
j. Sheep Sorrel

## WEED CONTROL

The adage know thine enemy works well with eradicating or controlling weeds in your garden. Are they annuals or perennials, trees or grassy rhizomes?

Annual weeds are generally the easiest to remove from the garden. By removing their heads with a hoe or cutting them with a trowel you prevent them from flowering and spilling their seeds in the garden. Mowing or using a weed wacker, especially along fence lines, is equally useful. By covering the ground with mulch, grass or densely matted groundcover, airborne seeds will not have the opportune chance to germinate.

Perennials are more persistent. Japanese knotweed (*Fallopia japonica*), for example will establish a branch-like root system that plunges several feet into packed earth appearing inside concrete walls, growing out of asphalt and spreading new seedlings 20 feet or more from the mother plant. We have dug holes 10 feet in diameter and five feet deep attempting to eradicate this plant from the garden.

### Rule Number One:

If students are not sure whether a plant is a weed or a desired plant, they should ask **BEFORE** they cut or uproot it.

### A good maintenance regimen should keep the weeds in check.

Generally speaking, herbicides as pre and post emergents are not recommended; they tend to get over-used and can damage your system, and on a larger scale, contaminate the regional ecology — but herbicides should be introduced to familiarize students with different methods of control. For deciduous trees that take hold and are apt to sprout from the trunk or roots, an application of glyphosphate herbicide -often marketed under the name Round-up, Rodeo and Kleenup — can be administered to the cut stem. Glyphosphate is taken up by the roots or stem and translocated to the plant's roots where it disrupts its metabolism. The herbicide is not only effective but because microorganisms in the soil quickly break it down it does not harm the environment. Tenacious plants such as Japanese knotweed and hard to handle vines such as poison ivy are also effectively controlled by this herbicide.

For handling weeds that poke up between bricks and stones, or in crushed stone pathways, try pouring vinegar between the cracks. The high acidity of vinegar radically alters the pH of that area and can kill existing weeds and grass while intermittently preventing the rapid growth of new ones.

## Identifying weeds

Perhaps the only way to familiarize students with the plants you want removed is to walk them through the gardens and across the grounds point out and pull weeds. Make a story about each one. Give it an identity by divulging its life cycle, interesting uses, its origin and method of propagating. Use a press and laminate different species after they've been keyed out and identified in the classroom.

## Exercise 1

### Weed identification scavenger hunt (to be done as a group exercise)

#### Materials:

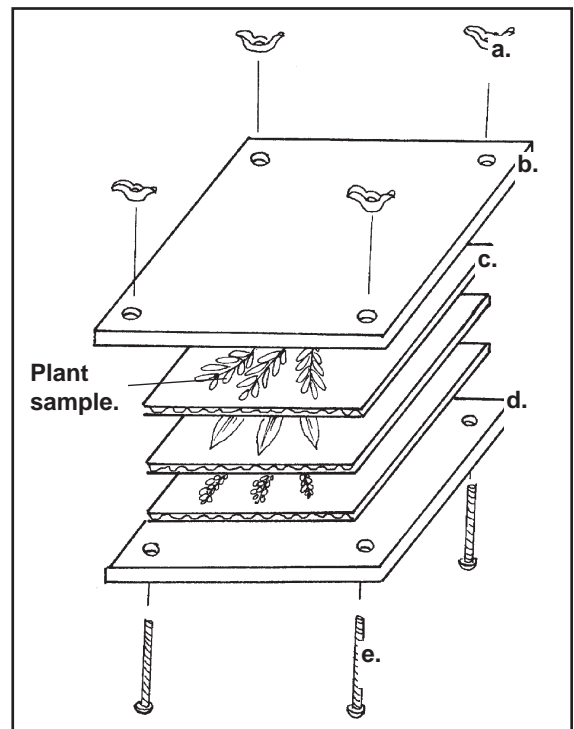
- \* A good weed guide
- \* Plant press
- \* Photographic examples of weeds common in your garden

#### Procedure:

- \* Shuffle and pass out pressed samples previously prepared.
- \* Scavengers spread out and search the garden for the plant they are seeking.
- \* Collect and press the samples complete include identification notes.
- \* Spread out and try again until everyone has had a chance to identify every plant.

Fig. 3. Making a simple plant press.

- a. Wing nut
- b. Cover
- c. Corrugated cardboard sheets
- d. Bottom
- e. Screws (length depends on the number of corrugated cardboard sheets)



Scans of actual dried pressed weeds here form our greenhouse collection



## INTEGRATED PEST MANAGEMENT

Integrated Pest Management is a growing field in horticulture and should be part of any horticulture program or can even be administered as a separate certificate course. Increasingly IPM has been coming into fashion as a generally effective way to control pests without using chemicals that harm the environment, or chemicals that pests can form resistance to.

IPM is a management technique that uses a combination of biological controls and preventative techniques in controlling pests and potential outbreaks.

Firstly, planting areas should be free of debris and weeds which can harbor populations of unwanted insects, fungus or airborne molds. Infected plants or leaves with black spot and other fungal problems should be pruned and disposed of away from the garden. Never put infested material in the compost pile. Clean all tools in a 10% bleach or alcohol solution after pruning plants infected with bacteria. Try not to water at night – wet debris, leaves or mulch, in the garden are susceptible to a number of fungal disease. Early watering is best when the sun can dry most of the leaves and litter. Clean up at the end of gardening season. Keep plants healthy.

Diversity is another preventative remedy. Infestations are generally plant specific. By grouping plants you are elongating the dinner table. Mix up crops in the vegetable garden with appropriate companion plantings. (see insert pg. 12-22.)

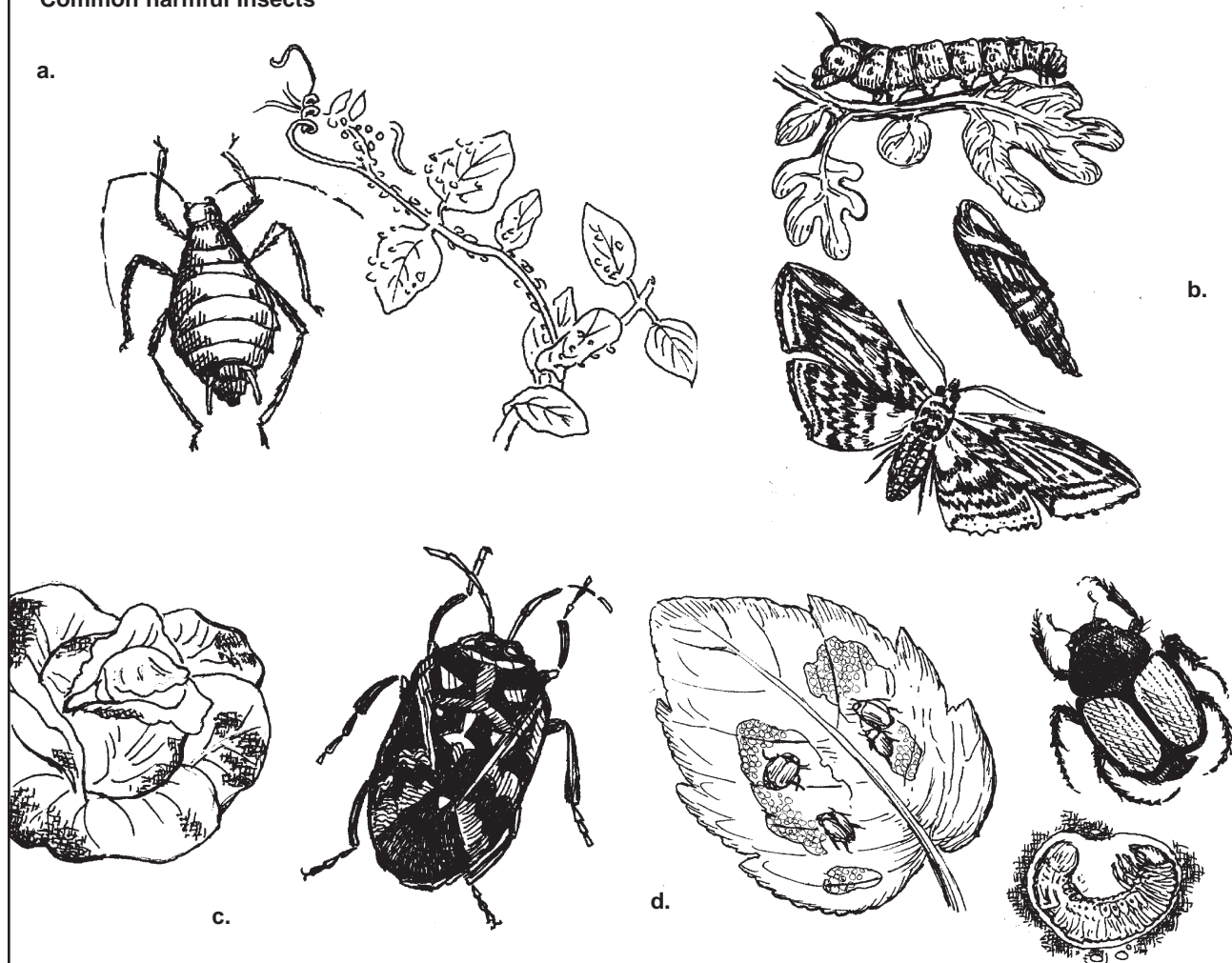
Constant observation and monitoring of the system is essential. As insects appear – Japanese beetles, tomato hornworms, aphids, harlequin bugs, for example – they should be immediately removed by hand, sprayed with a jet of water, or by using insecticidal soaps that are made from organic substances and break down easily in the soil. Neem, a substance from the neem tree, has been used in Asia as a natural insecticide since early civilization and is now a popular treatment with organic growers.

Row covers for crops can be used to prevent insects such as spinach leaf miners from alighting and laying eggs on young spinach plants.

The first sign of pests should also initiate the release of biological controls – natural predators that feast on specific or a variety of harmful insects. The release of ladybugs is a common method of controlling aphids and also scales, thrips and small caterpillars. The released ladybugs need cover to lay their eggs which hatch into tiny alligator shaped larvae. The larvae feed for 3 to 4 weeks on aphids before entering the pupal stage and becoming an adult. Lacewings are also voracious aphid feeders can be purchased for release. Other insects that should be encouraged are listed on page 12-11.



# Common harmful Insects



**Fig. 4. Some common harmful insects.**

**a. Aphid** – found throughout the garden and is in turn the prey of carnivorous insects.

**b. Tomatoe horn worm** which becomes the five spotted hawk moth.

**c. Harlequin bug.** They were often found amongst the lettuces.

**d. Japanese Beetle** – leaves eaten away to a lacy transparency may be a sign of Japanese beetle.

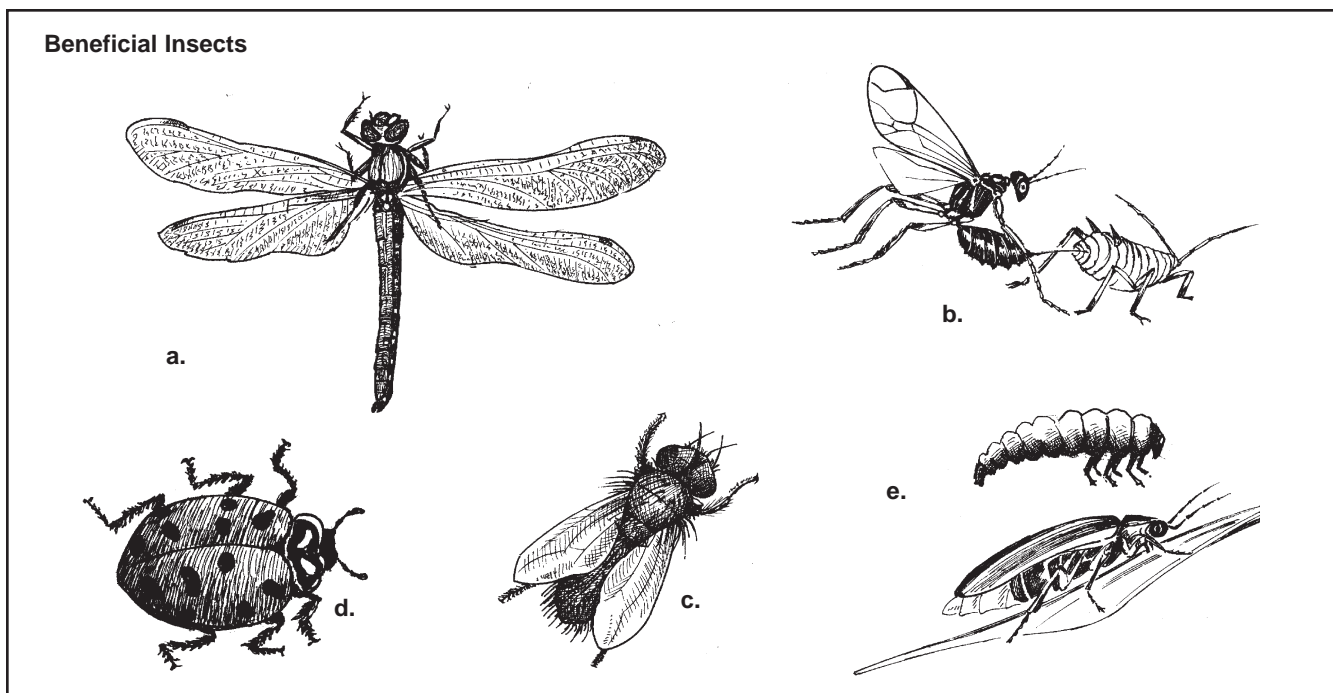
## The Top Ten Insect Pests

Insect	Favorite Plants	Damage	Treatment
Aphids Tiny pear-shaped; long antennae, 2 tubes projecting rearward from abdomen	Almost all plants found throughout North America: fruits, vegetables, flowers, ornamentals, and shade trees	The honeydew excreted on leaves supports mold; the aphids eat the plant's sap which decimates foliage and causes leaves to drop.	Water alone may help. Fortunately there are many native predators: aphid midges, lacewings, or lady bugs. Garlic spray and insecticidal soap are also effective. Alcohol and pyrethrins in extreme cases.
Cabbage Maggot Adults: 1/4" gray flies Larvae: white, tapering maggots	Cabbage family plants	Roots are vulnerable to these root-tunneling insects. Diseases enter the compromised roots or else plants are killed directly.	Setting out transplants in tar paper through slits; delayed planting inhibits first generation; wood ashes, diatomaceous earth, red pepper dust are all effective.
Caterpillars: Soft, segmented larvae with distinct, head capsule, six legs in front, fleshy false legs behind.	Fruits and vegetables, ornamentals and shade trees in many different areas.	While some tunnel into roots, most eat the leaves.	Seek out native predators. Hand picking is effective. Pyrethrins.
Colorado Potato Beetle: Yellow orange beetles with 10 black stripes on wing covers. Larvae: orange, hump-backed grubs with black spots on sides	Potatoes, tomatoes, eggplant and petunias. Found in many different areas.	If young plants are not killed, then the danger is defoliation.	Deep straw mulch together with efforts to attract native parasites and picking. Neem and pyrethrins spray may be necessary.
Cutworms: Fat, 1" long gray or black segmented larvae, active at night	Most early vegetable and flower seedlings, transplants. North America	Cutworms chew through stems at ground level, they may completely devour small plants.	Delay planting, hand-pick cutworms curled below soil, scatter bran baits mixed with BTK and molasses.

There are certain insects who almost anyone who has a garden is likely to be familiar with. They are so omnipresent that it is really almost impossible to get rid of them. The popular wisdom often runs to synthesized pesticides. They can cause serious effects on the friendly insect and animal population. Encourage your students to use environmentally-friendly remedies first. Study these amazing creatures, because you will never get rid of them entirely.

<b>Insect</b>	<b>Favorite Plants</b>	<b>Damage</b>	<b>Treatment</b>
Flea beetles: Small dark beetles that jump like fleas when disturbed	vegetables and flowers, small fruit, found in North America	Adults chew numerous small, round holes in leaves, most damage to young plants, larvae feed on roots.	Apply parasitic nematodes to soil, spray with neem, pyrethrins.
Japanese beetle: Adults: metallic blue-green, 1/2" beetles with bronze wing covers. Larvae: fat white grubs with brown heads	vegetables and flowers, small fruit, found in all states east of the Mississippi	Adults skeletonize leaves, chew flowers, may completely defoliate plants; larvae feed on plant roots.	Shake beetles from plants in early morning, set out baited traps, apply milky disease spores to soil.
Mexican Bean Beetle: Adults: oval yellow-brown, 1/4" beetles with 16 black spots on wing covers. Larvae: fat, dark yellow grubs with long branched spines	Cowpeas, lima beans, snap beans, soybeans, found in most states east of the Mississippi, some western states	Adults and larvae chew on leaves from beneath, leaving characteristic lacy appearance; plants defoliated and killed.	Plant bush beans early, handpick, release spined soldier bugs, spray neem and pyrethrins.
Scales: Adults: females look like hard or soft bumps on stems, leaves, fruit; males are minute flying insects larvae: tiny, soft, crawling larvae with threadlike mouthparts.	Many fruits, indoor plants, ornamental shrub and trees throughout North America	All stages suck plant sap, weakening plants; plants become yellow, drop leaves and may die.	Prune out infested plant parts, encourage native biological controls, scrub scales gently from twigs with soft brush and soapy water, spray with pyrethrins.
Tarnished Plant Bug: Fast-moving, mottled, green or brown bugs, forewings	Many flowers, fruits, vegetables found throughout North America	Adults and nymphs suck plant juices causing leaf and fruit distortion, wilting, stunting and dieback.	Encourage native predatory insects.





**Fig. 5. Beneficial Insects.**

**a. Dragonfly**

**b. Parasitic wasps lay their eggs within the bodies of aphid.**

**c. Tachnid flyd.**

**d. Everyone's favorite beetle – the lady beetle. She always has either 6 or 12 spots.**

**e. Firefly and larvae. Firefly larvae are carnivorous, feeding on insects and mollusks which they subdue with poison from their mandibles.**

\* Dragonflies --They feed on mosquitoes, gnats and midges.

\* Fireflies – They eat larvae of such pest as slugs and snails. Fireflies need tall grass to lay their eggs. A small space could be preserved as a meadow, or grass mowed high (3 inches) to preserve their eggs.

\* Parasitic wasps – a variety of species which attack specific insects. Trichogramma wasps parasitize cabbage looper eggs. Chacids, braconids and ichneumonids control whiteflies, aphids and some caterpillars.

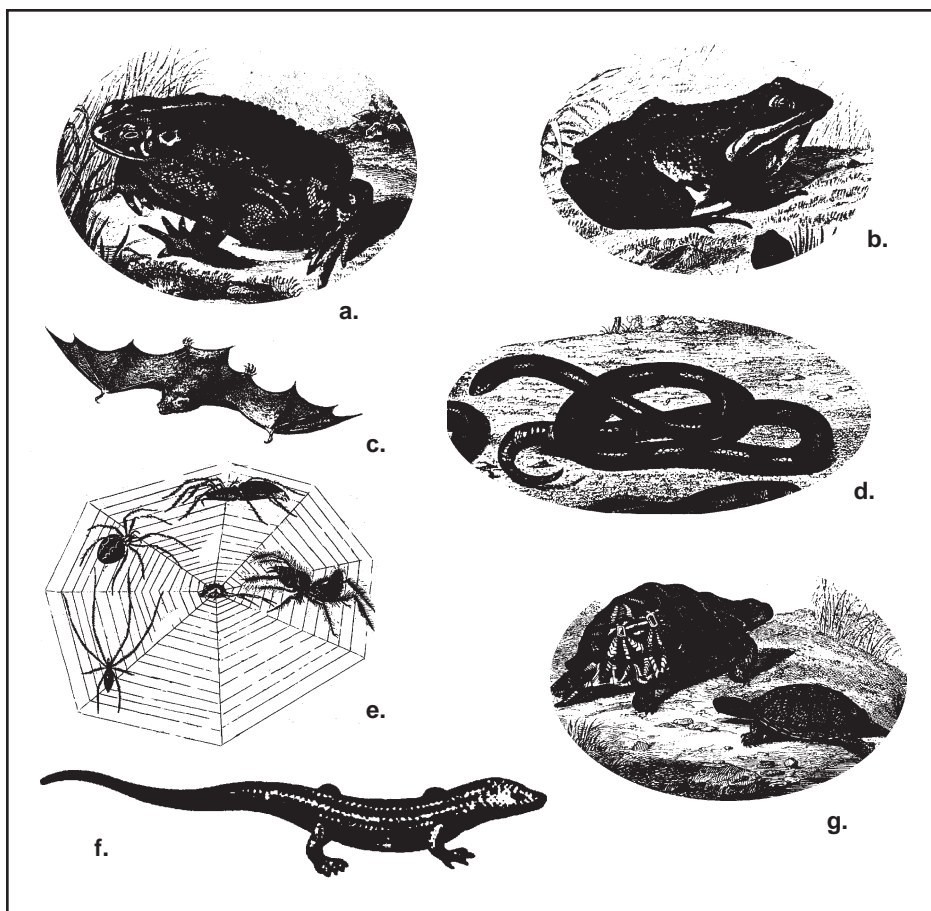
\* Rove beetles – vary in size but generally feed on insects found in garden litter including slugs, snails and root maggots. They are effective in helping organic matter decompose.

\* Tachnid flies – lay their eggs on cutworms, beetle larvae, caterpillars, corn borers and stinkbugs. The larvae then parasitize the host insects. The adult tachnids look like large houseflies.

Birds and bats also ingest great quantities of insect pests. Feeders and houses, plants with appropriate food and cover and water to bathe and drink will attract year round residents to your garden. Bat boxes are becoming more popular among gardeners, and should be encouraged. As rural areas become increasingly suburbanized, bat habitat has been steadily decreasing.

Encouraging habit for spiders, toads, frogs, salamanders, and even snakes strengthens the controls for a well-balanced system. Stone walls, ponds, areas for tall grass or wildflower meadows provide habitat for a variety of animals that are voracious feeders of garden pests.

<b>Beneficial Species</b>	<b>Pest Controlled</b>	<b>Notes</b>
Aphid midge (Aphidoletes aphidimyza)	Aphids, many species	Greenhouses, shade trees, orchards, gardens. 3-5 pupae per plant.
Braconid wasp (Ahidius matricariae)	Green peach and apple aphids	Plant parsley-family flowers to provide a food source.
Convergent lady beetle (Hippodamia convergens)	Aphids	Can hibernate in cool greenhouse.
Lacewings (Chrysoperia carnea, Chrysoperla rufilabrus)	Any small, soft pests including aphids, thripa	Apply 1-3 eggs per plant.
Mealybug destroyer (Crytolaemus montrouzieri)	Mealybugs	Greenhouse or house plants, 2-5 per plant
Minute pirate bug (Orius tristicolor)	Thrips, mites	Release 1-3 per plant. Attracted to pollen rich plants.
Scale predator beetles (Chilocorus spp., Lindorus spp.)	Soft scales	Greenhouse, house plants, ornamental, citrus trees.
Spined soldier bug (Podisus marculiventris)	Colorado potato betle, Mexican bean beetle	Try 5 per square yard.
Whitefly parasite (Encarsia formosa)	Greenhouse whiteflies	Greenhouse or warm garden. 5 per plant at first sight of whitefly
<b>Non-Insects</b>		
Predatory mite (Phytoseiulus persimilis)	Fungus gnats, thrips	Greenhouse, house plants, or ornamentals
Predatory mite (Phytoseiulus persimilis)	Spider mites	2-5 per plant in green house, house plant or on strawberries
Western predatory mite (Metaseiulus occidentalis)	European red mite	50-100 mites per tree, 1000 per tree to stem outbreak. Also good on strawberries.



**Fig. 6. Beneficial reptiles, animals, and spiders. These creatures all devour large numbers of insect pests.**

a. Toad

b. Frog

c. Bat

d. Snake

e. Spiders

f. Salamander

g. Turtles

## Exercise 2

### Identifying Insects (a group activity)

#### Materials:

- \* A good book of garden insects, both helpful and harmful

- \* Several small jars for collecting specimens
- \* Notebooks, pencils, watercolors and brushes

- \* Magnifying glasses

#### Procedure:

- \* Tour the garden as a group examining all the plants in the various beds.
- \* Search for insects: remember to look under leaves as well as on top of and around the adjacent soil.
- \* Collect samples of insects in the specimen bottles.
- \* Use the insect guide to identify as many insects as you can: remember that the life cycle of an insect includes a pupal and larval stage as well as the adult.
- \* Note down the damage you observe, if any.
- \* Later in the classroom make detailed drawings and paintings of the insects.
- \* Helpful insects should be released; unfortunately harmful ones may have to be destroyed.

## IDENTIFYING INSECTS

Students should be taught which insects are beneficial and which are harmful. At Rikers, we have several insect identification books that students use to identify insects they find in the garden. By familiarizing themselves with the names of different insects, they will begin to identify those which are harmful, benefactors or potential pollinators like bees and butterflies. Once a student has identified a pest, we require them to research and implement the most effective control for that insect.

This is the first important step of becoming an IPN practitioner. Learning the attributes or life cycles of common insects, their relationships as pest and predator in a system of controls and balance helps students understand concepts of ecology and deepens their appreciation of natural gardening.

## Microorganisms

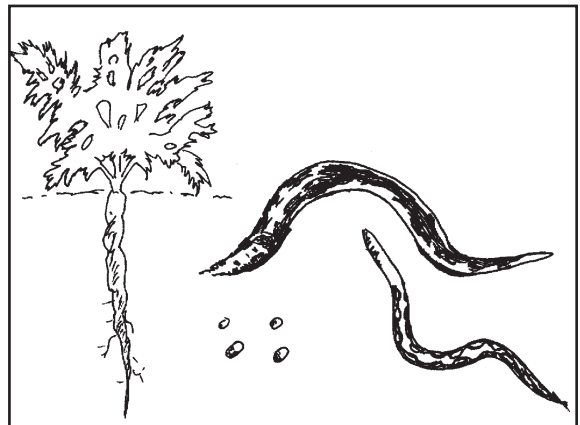
Microorganisms are also employed as another weapon in the IPM arsenal. Most popular is bacterium *Bacillus thuringiensis* or Bt and sold under the name Thuricide and Dipel. The bacterium can be sprayed on leaves or applied in a granular form and works by paralyzing the intestinal tract of caterpillars. Different formulas are developed and applied for combating different insects. Check the labels for your specific needs before purchasing.

Nematodes, tiny worm-like animals that are part of the soil micro-fauna, eat a number of pests such as cut worms, Japanese beetle larvae, root maggots and more. *Neoaplectana carpocapse*, also known as Nc, is especially useful. Milky Spore Disease is a pathogen containing *Bacillus popilliae* and *B. lentimorbus* and is applied to the lawn to control grubs and Japanese Beetle larvae.

**REMEMBER:** A strong dose of chemical or even organic pesticides can damage your inventory of pathogen spores, microorganisms and insect predators and offset the careful checks and balances that comprise a healthy, natural system.

**Fig. 7 Nematode (actual size .30 mm). An adult and juvenile nematode with eggs in lower left corner. These microscopic animals include hookworms, whipworms and pin worms. Others of these parasites help to break down organic material in the soil.**

Stunted carrot plants with yellow leaves may be suffering from rootknot nematode. Interplanting with marigold will help control this pest.



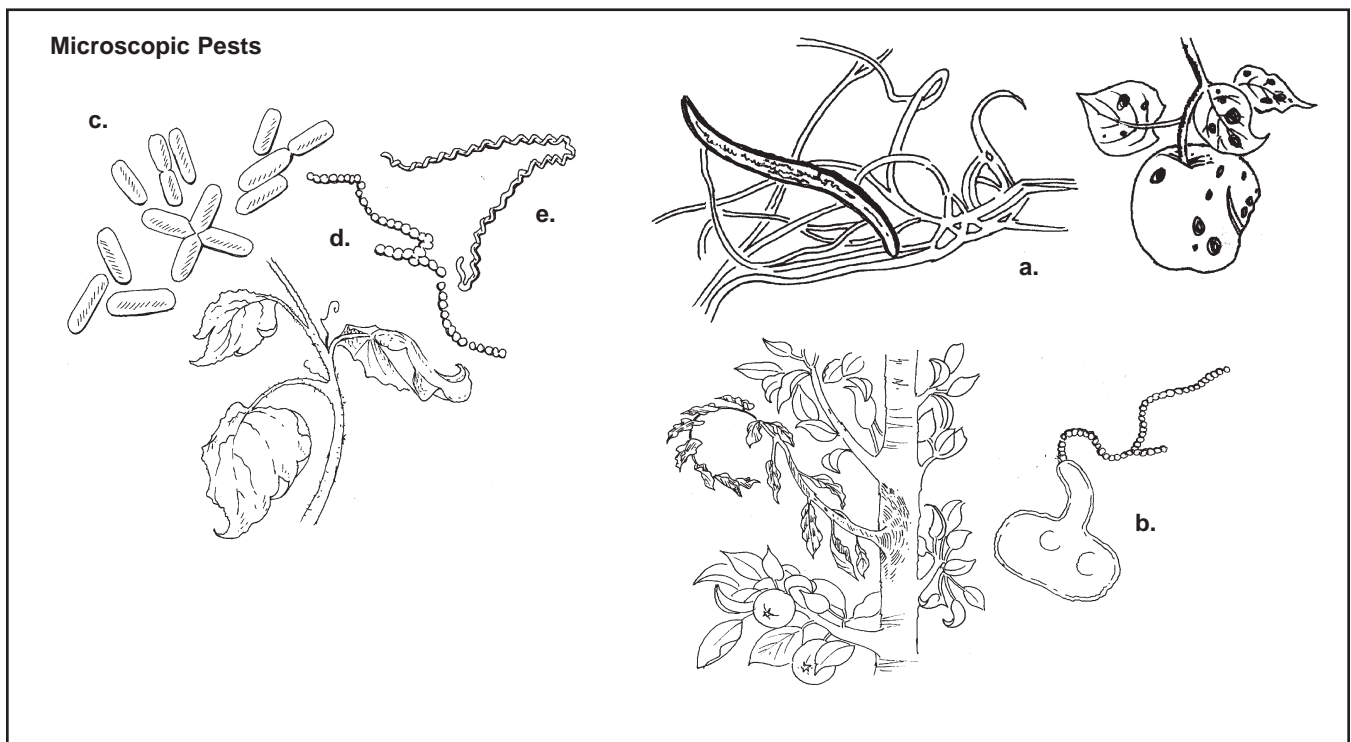


## PLANT DISEASE

Disease is everywhere in the garden, either striking plants discretely that are under-nourished or stressed, or becoming an infectious epidemic. Plant disease is generally caused by three organisms – fungi, viruses and bacteria and each one has different symptoms and cures.

Fungi, including molds and mildew, attacks leaves and fruit. Black spot on roses is a fungus that can spread through water. Keeping leaves dry is an effective control; since the spores are carried throughout your system by splashing water, allow the leaves of infected plants to dry during the day by watering in the morning and at the base of the plant. Deep pruning can control brown rot on the fruits of apricot peach and nectarines, and removing all infected fruit from the ground and spraying with a fungicide during the bloom period the following spring.

For Fusarium wilt and Verticillium wilt (creates wilting in vegetables and other herbaceous plants and strains are often plant specific) you may have to remove the infected plants and solarize the soil. The Fusarium attacks the plant by sending out thin strands of mycelium which parasitize the plant by entering its roots and attacking its water conducting vessels. Because the fungus is in the top 6 inches of the soil, refrain from tilling. It is also suggested to strategize a crop rotation and use plants not susceptible to the particular strain infesting your plants.



**Fig. 7. Microscopic Organisms.**

**a.** This predacious fungi has trapped a nematode. Once the worm has been trapped, fungal hyphae grow into its body and digest it. Small dark spots on fruit can be caused by fungal infection.

**b.** A cell of *Bdellovibrio bacteriovorus* is attacking a cell of an apple tree. Fire-blight-damage-infected blossoms appear water soaked; infected twigs suddenly wilt.

Three major forms of Bacteria. **c.** Bacilli, **d.** Nitrosococcus soil bacteria that oxidize ammonia to nitrates and **e.** Spirilla. Wilted leaves can indicate bacterial infection.

### **Exercise 3**

#### **Steps for IPM**

#### **Materials:**

- \* Toxic free pest control manuals
- \* Plant damage manuals
- \* The notebook entries about insects you prepared in the previous exercise
- \* Soil testing kit

#### **Procedure:**

- \* Monitor the plants – this should be part of your general maintenance system
- \* Identify pests. Don't make assumptions that the damage was caused by a certain insect. Find it in the act!
- \* Assess damage – Is the damage injurious to the plant or simply a few munched leaves? Is it endemic with your plants throughout the garden?
- \* Choose the least toxic control – Employ different strategies without resorting to organically derived pesticides. Aphids on tomatoes can first be fought with a jet spray of water (unless the force is damaging to a young plant). If that doesn't work, an insecticidal soap may be used. Release ladybugs. Finally, if they persist as an infestation, an organic pesticide may be necessary.
- \* Reevaluate the damage – are they back? Wait a week before applying the next method of control.
- \* Check and evaluate other reasons of plant stress – Plants tend to develop mechanisms for defense that can repel or withstand insect pests. Often healthy plants do not attract disease or pests. Other factors to consider for a stressed plant is soil pH, watering methods, air pockets (perhaps the greatest cause of mortality on Rikers is a poorly planted plant), light and nutrients. Often the problem can be attributed to problems below ground. Borers can damage plant roots. The problem may also be a fungus disease.
- \* Make a chart like the one given above that provides records the observations made during routine IPM

Bacteria is spread by wind and rain as well as by insects from one plant to the other. In tropical areas, problems may persist but in temperate regions, the winter cold will kill off that year's problem. Bacteria wilt is a common disease which affects vegetables. Plants wilt and dry, but to be sure it is bacteria wilt cut the stem, put both ends together and gently squeeze. A white mucous thread will indicate the disease is present. Fireblight affects pear, apple, pyracantha, serviceberry and others by wilting the leaves, shoots and fruit which turn a sooty black. You should prune below the infected part and sometimes apply streptomycin or Bordeaux mixture during the bloom period.

Viruses affect parts of the plant without necessarily killing it or causing it to wilt. Leaves and stems may twist or the leaves can become crinkled. Mosaic virus attacks many plants and can be controlled by controlling the insects such as aphids, whiteflies, thrips and leaf hoppers that spread the disease.

There is often more than one possible explanation for each symptom that affects plants. Learning to observe your garden, house, and greenhouse plants is the key to keeping them healthy.

## Symptom

## Cause

### WHOLE PLANT OR PLANT PART WILTS

- \* Whole plant or tips wilt, recovers when watered
- \* Whole plant or branch wilts, stays wilted

Water stress  
Borers, blights, or viruses

### ALL FOLIAGE AND STEMS DISTORTED

- \* Leaves, stems long and narrow, plant stunted
- ### DISCOLORED LEAVES

Viruses

- New leaves yellow or light green
- \* Veins paler, growth rapid
  - \* Yellow patches on older leaves, stem center brown

Yellow virus  
Wilts  
  
Nitrogen deficiency

Old leaves yellow, turn brown, drop off

- Leaves blotchy light green, yellowish, or white
- \* between veins
  - \* patterns crossing veins, may be ring shaped

Nutrient deficiency  
Mosaic virus

- Leaves black or scorched
- \* wipes off
  - \* won't wipe off

Sooty mold from insect feeding  
Fire blight

Leaves grey or whitish

Mildew

- Leaves yellow or pale, stippled
- \* fine webbing on underside
  - \* silvery sheen to damage
  - \* blotchy patterns, spots of excrement present

Spider mites  
Thrips  
Lace bugs

### HOLES IN LEAVES

- Small holes
- \* with cleanly cut edges
  - \* With dry, dark edges, leaves also have spots

Flea beetles  
Bacterial leaf spot

### FLOWERS DISTORTED

Aphids  
Plant bugs

- Petals have silver patches or streaks  
Flowers drop before opening

Symptoms	Causes
FRUITS DROP BEFORE OPENING	
Fruits with normal exterior	
* Interior tunneled and mined	Insect damage
Shriveled fruits, early-ripening cultivars most affected	Fruit maggots
Scarred distorted fruits	Disease, plant bugs
FRUIT DAMAGED, STAYS ON TREE	
Fruits with large, chewed holes	Caterpillars
Fruits have discolored areas	
* Always on tip ends	Blossom-end rot
* Also on soft parts	Bacterial or fungal disease
Fruit distorted, puckered	Plant bugs
OTHER SYMPTOMS	
Buds shrivel or rot before opening	Japanese beetles and other insects
Chewed flowers	
BRANCH OR WHOLE PLANT WILTS	
Holes in stem or trunk, gummy sap or sawdust	Boring insects
Collapsed areas on stem with soft, watery, brown discoloration	Botrytis, soft rots
TRANSPLANT OR SEEDLING STEMS COLLAPSED OR CUT OFF	
Cut stem crisp, appears healthy	
* trail of silvery mucus on soil	Slugs or snails
* no mucus trail present	Cutworms or animals
TIPS OF BRANCHES, TWIGS DIE BACK	
Growth blackened	Insects
* Also distorted and wilted	Plant bugs
OTHER SYMPTOMS	
	Scale, mealybugs
Small bumps on stems and leaf veins, honey-dew present	



#### Exercise 4

**Homemade solutions can be an effective way to control black spot on roses or peach leaf curl. There are also many home remedies against aphids.**

##### **Materials 1, black spot remedy:**

- \* 1 gallon of water
- \* 1 tablespoon of baking soda
- \* 3 drops of vegetable oil
- \* 3 drops of liquid soap such as Ivory
- \* Pump style spray bottle like those used for household cleansers. If you plan to recycle a household cleaner bottle, make sure it is thoroughly cleaned as they may contain harsh chemicals that can damage plants or irritate skin and eyes.

##### **Procedure 1:**

- \* Mix baking soda, liquid soap such as ivory and vegetable oil.
- \* Fill spray bottle and carefully treat affected plants.

##### **Materials 2, peach leaf curl remedy**

- \* 1 gallon of water
- \* 1 cap-full of listerine
- \* 3 drops of liquid soap such as Ivory
- \* Pump-style spray bottle

##### **Procedure 2:**

- \* Mix water, listerine and soap
- \* Fill spray bottle; treat and monitor affected plants by spraying directly onto leaves. Repeat if necessary after one week.

##### **Materials 3, aphid remedy**

- \* cigarette butts
- \* 1 gallon of water
- \* Spray bottle

##### **Procedure 3:**

- \* Steep cigarette butts in water for one week.
- \* Fill spray bottle and treat affected non-agricultural plants by spraying directly on leaves and on soil around leaves.
- \* Monitor aphids, repeat after one week if necessary.



**Fig. 8. Pond water or even puddle water can help you illustrate the effectiveness of home remedies. Simply collect some pond water and observe the microorganisms found in it under a microscope. Notice the effect when you place a drop of your home made remedy on the slide.**

## Exercise 5

### Diagnosing plant problems and creating an IPM plan to cope with them

#### Materials:

- \* A good guide to plant disease
- \* Index cards and waterproof markers
- \* Notebook

#### Procedure:

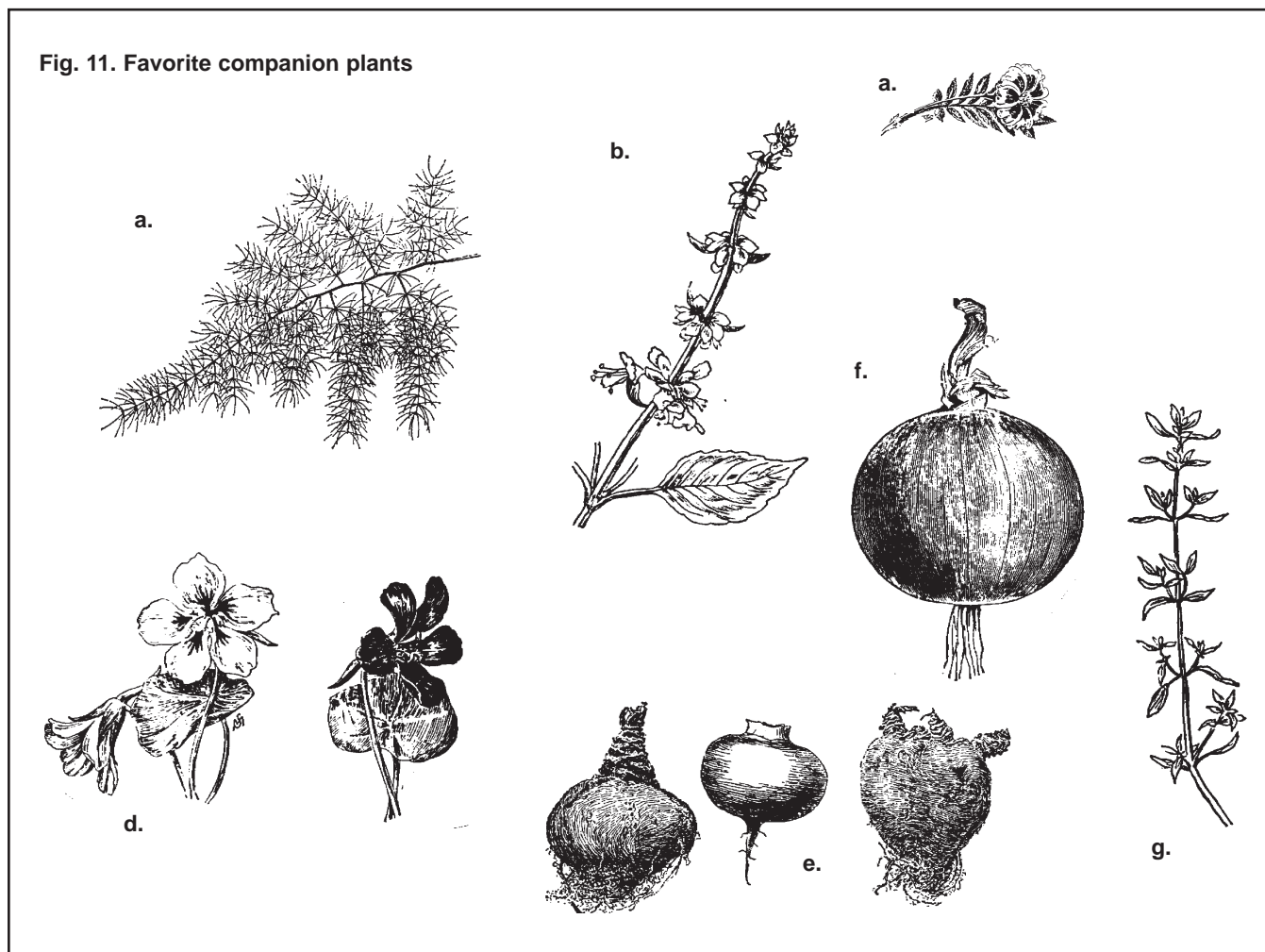
- \* Carefully observe the outdoor and house plants in your garden or greenhouse.
- \* For indoor plants, note down signs of disease, pests, under or overwatering and poor nutrition on index cards and place them in front of each plant.
- \* Signs of disease, insect damage or stress on outdoor plants can be recorded in a notebook
- \* Research the probable causes and possible treatments for the conditions you observe. List organic and chemical treatments separately
- \* Write out the IPM plan suited to each of the affected plants or group of plants on the index cards or in your notebook.



**Fig. 10 Creating an IPM plan.** These students are recording their observations about the health of their greenhouse plants. Later on they will research the possible causes of disease, pest damage, or environmental stress. Recommendations written out on index cards and placed near the affected plant or group of plants or recorded in notebooks. Remember to include the date for later reference.

## COMPANION PLANTING

Plants emit a variety of chemicals and scents that can ward off potential pests in the garden. By mixing and creating combinations of flowers, vegetables and herbs in your garden, you can strengthen your system with self-protective measures against harmful insects. Certain plant combinations also enhance growth and flavor. Attractant crops such as fennel are plants that bring beneficial insects to the garden that will help keep pests in check. Repellent crops drive pests away. Aromatic marigolds, for example, emit a substance from their roots which repel root-sucking nematodes. At Rikers, we plant a border of the garden with marigolds, and this leads into an instructive lesson on secondary compounds and plant defense mechanisms. Garlic gives off a smelling compound that actually kills onion flies and aphids.



**Fig. 11 Common Companion Plants.**

- a. Asparagus (the presence of the roots in the soil inhibits stubby root nematode).
- b. Sweet basil.
- c. Marigold – sow thickly.
- d. Nasturtium
- e. Turnip Roots
- f. Onion
- g. Thyme

NOTE: There is no formula or combination that works every time. Conditions, levels of infestation, soil pH and drainage, unseasonally wet or dry weather can all have an impact on the effectiveness of your system. Have students record and document your planting system. Set up trials. One plot of row crops and the other a specific companion system (far enough way from each other) and check the difference.

Allies are plants that either enhance growth of nearby plants by providing nutrients, such as beans and peas and other leguminous, nitrogen-fixing plants, or can be grown in proximity without competing for light, surface space and nutrients (and which allows you to increase production in a smaller space). The Three Sisters is an example of a finely attuned companion planting system.

### Plants which traditionally should and should not be planted together

Plant	Helpful	Harmful
1. Asparagus	11 W	7
2. Beans	4 5 8 10 12 W	7 to Z
3. Cabbage family	X Y	
4. Carrots	2 5 6 7 8 12 W	
5. Leeks	2 4 8 12	
6. Lettuce	4 10	
7. Onions, Garlic	4	2 3 10
8. Peas	2 4 5 12 X	7
9. Potatoes	2 10 X	11 Y
10. Strawberries	2 6	3
11. Tomatoes	1 W X	9
12. Turnips	2 4 5 W	
W. Parsley		
X. Marigolds		
Y. Rosemary, mint, thyme, chamomile		
Z. Rue		

Source: Old Wives Lore from Gardeners. Maureen & Bridget Boland, The Bodley Head Ltd.; London 1976



Plant enemies have the opposite effect; these are plants that will out-compete its neighbors robbing them of sun or nutrients, or harboring pests and diseases that can damage different plants adjacent to them. Other plants emit chemicals through their roots which act as herbicides and inhibits growth in other plants. Called allelopathy, it occurs with black walnut, fennel and to some extent sunflowers.

Companion planting is more than just creating diversity, it is a combination of time-tested combinations and traditional folklore that enhances productivity and brings texture, shape and color to the garden.

## **Exercise 6**

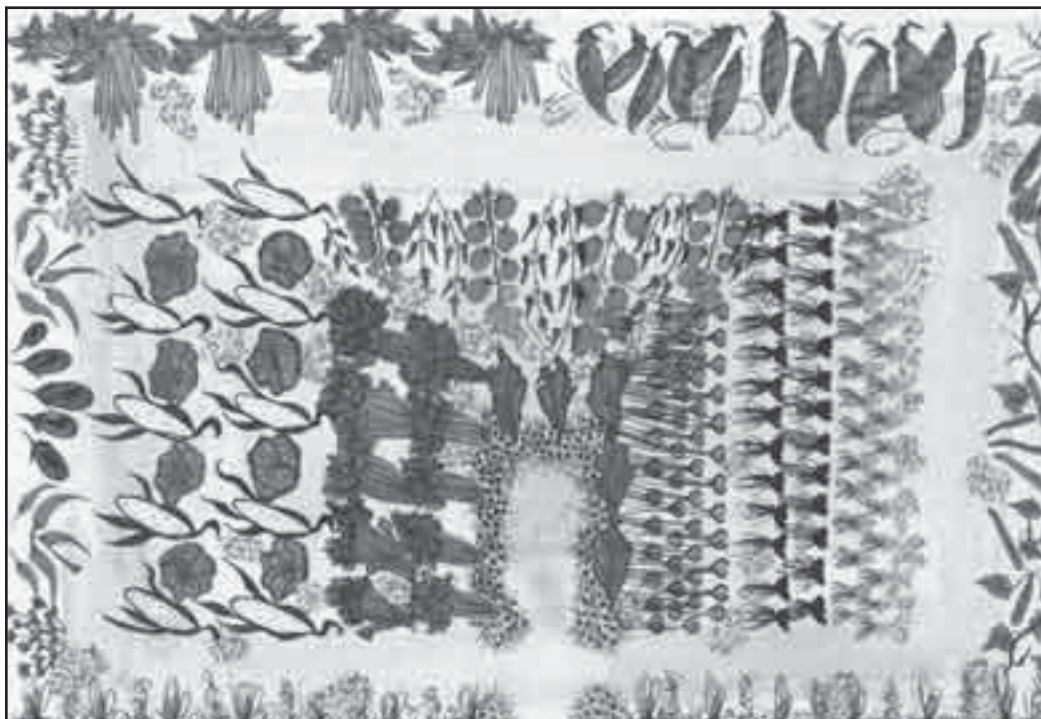
### **Draw a Companion planting plan for your vegetable garden**

#### **Materials:**

- \* Companion planting chart      \* 1/4" graph paper      \* Pencils, eraser      \* Tape measure
- \* Tracing paper      \* Garden design book

#### **Procedure:**

- \* Measure the site or bed you are going to plant and make a 1/4" = 1' scale drawing on graph paper.
- \* Make an inventory of the plants you have and or will need to purchase or grow in order to create an effective companion planting scheme. Include as many beneficial companions as you can.
- \* On tracing paper laid over your graph paper scale drawing, lay out either a formal or informal garden. Make several sketches
- \* Using your companion planting charts and your inventory, create a layout that pairs plants most beneficial to each other. Be aware that some plants can also have bad effects on each other.



**Fig 12. Companion planting plan.**

**This plan was drawn by one of the students of our horticulture program.**



### Some important companion plants and the pests they help control

Companion Plant	Associated Plant	Pest	Notes
Turnip Root	Peas	Spider Mites, Pea Aphids	
Asparagus Roots	Tomatoes	Stubby Root Nematode	
Boston Fern	All vegetables	Southern Army Worm	
Tomatoe Leaves	All vegetables	Some Weevils	
Marigold (scented)	All vegetables	Nematodes	Sow thickly
* Mints	All vegetables	Aphids	Spreads quickly
Rue	All vegetables	Japanese Beetles	May give rash to some people
Sweet Basil	All vegetables	Fungus, Milkweed Bugs	
Tansy	All vegetables except cabbage	Japanese Beetles, Squash Bugs	May attract cabbage worms
Thyme	Cabbage	Cabbage Worms	
Catnip	Eggplant	Flea Beetles	
Onions	Carrots	Rust Fleas, Nematodes	
Horse Radish	Potatoes	Potatoe Beetle	
Nasturtium	Cucumber	Cucumber Beetle	
Beans	Corn		increased yield
*Parsley, Basil	Toamatoes	Aphids	

Source: Rodale's All-New Encyclopedia of Organic Gardening. Edited by Fern Marshall Bradley and Barbara W. Ellis; Rodale Press, Emmanus, Pennsylvania, 1992

\* Results of our own planting schemes at the Rikers Island Facility

## WATERING

Summer or the hot season is the time when students will spend a good time either watering by hand or setting up a system that will do the job for them. It is always best to water in the morning when the sun can dry off the leaves and help prevent the outbreak and spread of leaf molds, rot and water spread diseases.

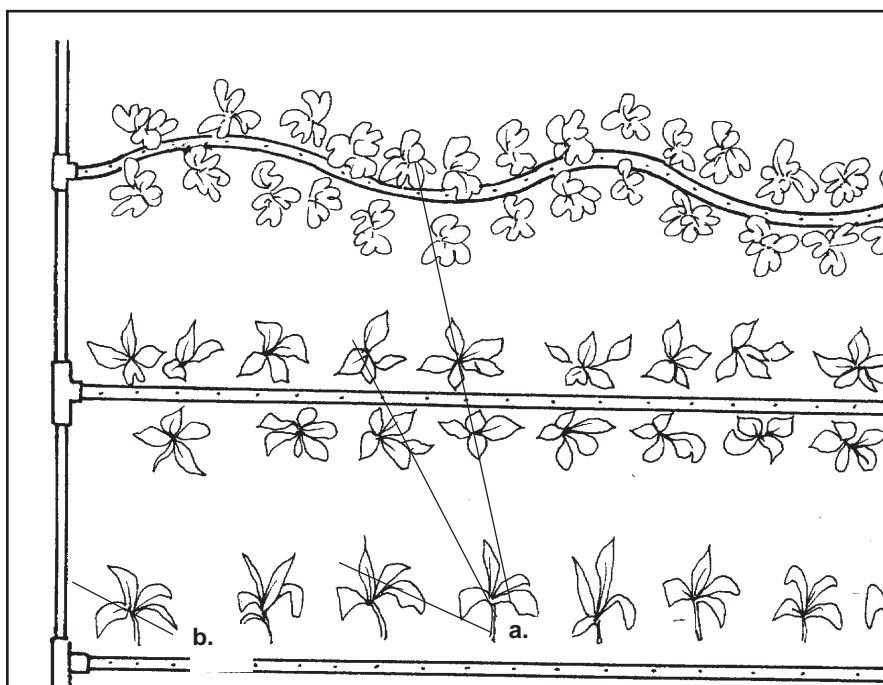
For well-drained sandy soil, and plenty of wind and sun, watering can take up a good portion of the day's maintenance activities. An irrigation system can offset the time and effort to keep the gardens properly watered. This may consist of either a drip irrigation system or an overhead system and will depend mostly on the availability of resources and materials.

Sites in low areas that collect water, or with hardpans or poorly drained clay soil, may require less water if there seems to be a high level of retention. Remember plants not suited to keeping their feet wet can die just as easily from too much water (root rot) then plants receiving too little.

Newly planted trees need up to 20 gallons of water per week during hot weather. This often means a good soaking by hand directly into the drip well. In following years, the amount of watering should be successively reduced to encourage good root development. The roots will spread and allow the tree to seek water on its own.

Drip irrigation is the most effective at conserving water and concentrating flow at the plant's roots. This in effect reduces moisture loss at the ground surface. Overhead systems lose moisture to the air through evaporation and are not as nearly effective at penetrating the soil surface. For large gardens, or if the gardens are spread out around the prison grounds, a transportable overhead system may be more feasible. Because many facilities do not run programs on weekends or long holidays, we suggest purchasing an affordable timer to ensure that the vegetable garden and other sites susceptible to hot weather are properly watered. The timer can be hooked directly to the outside spigot and attached to an overhead sprinkler.

NOTE: It may be advisable to create a small-scale project demonstrating how different drip irrigation systems are properly installed.



**Fig. 13. A simple drip irrigation system.**

**Set up your drip hoses before you plant your seedlings. It might be best to wait till your seedlings have become established before turning on the system. Up until that time the plants might prefer a less effective but gentler sprinkler type system.**

**a. hoses**

**b. connectors**

## **Exercise 7**

### **Developing Simple Irrigation Systems**

#### **Materials:**

- \* Paper, pencils, ruler, and tape measure
- \* One of the garden plans already prepared in a previous exercise but not yet installed
- \* Landscaping material supplier's catalog

#### **Procedure:**

- \* Plot out the most efficient way of laying out the drip hoses for the garden you choose to irrigate in this way.
- \* Calculate the amount of hose you will need, including connectors and plugs to end the lines.
- \* Research the cost of the necessary materials in a supplier's catalog.
- \* Contact suppliers with a wish list, requesting donations or discounts. Many suppliers will make donations or discounts of slightly damaged materials.
- \* If you are successful in obtaining the necessary materials, remember that it is always best to install drip hoses before placing the plants so as not to disturb the roots.

## **A Word on Xeriscaping (Xeros meaning dry)**

In planning a garden, the availability and location of water should be a primary concern in determining the kinds of plants to be grown. As you move further away from a watering source, plants more adaptable to drought conditions are a more advisable choice. Typically, xeriscaping requires native plants, since natives have adapted over time to rain-fed conditions. In temperate regions, many of our store-bought perennials originate from the mid-west and have long blooms throughout the summer. Echinacea, liatrus, fennel, yarrow, and rudbeckia, as well as grasses such as the non-native fescue and blue oat are just a few of the more colorful arrangements that will tolerate dry summer conditions.

### **It's all in the leaf**

All plants need water but drought tolerant species have leaves that are specially adapted to dry conditions that prevent water loss. Leaves are often narrow in shape to reduce surface area, thick or waxy, gray or silver colored to reflect light, and absorb less heat than dark green leaves. They are also hairy to lessen turbulence at the leaf surface, or succulent – acting as water storage units.

What are the native or specially adapted plants in your region that can be a part of your prison xeriscape? Remember, your design should be built around the time and resources available to effectively maintain the system. Maintenance IS the discipline of gardening, and any program should incorporate different strategies to use these tasks as stepping stones for learning not only about horticulture but the science behind it as well.



**Fig. 14. Drought resistant plants.**

- a. Blue Oat**
- b. Echinacea**
- c. Liatrus**
- d. Rudbekia**
- e. Yarrow**

Notice the shapes of the leaves of drought resistant plants. They are often narrow and thick or waxy. They may be light colored or grey and hairy. all these features allow the plant to resist the drying effect of the sun's rays.

## **PROFILE: AUGUSTA STATE MEDICAL PRISON**

Ron Whittaker is the Deputy Warden of Care and Treatment at Augusta State Medical Prison. Five inmates who passed through the horticultural vocational program at Augusta State Medical Prison lead and have taken on the responsibility for training ten other inmates who are part of the crew that looks after the grounds. Though the name of the facility may suggest that the inmates are there for medical reasons, there is a general population. At other times there has been a gardening program for the mentally-handicapped inmates and Ron is sure it had a positive effect on their motivation, skill level, and self-pride.

The vocational program has moved to another institution but its legacy still is felt through the skills transferred by those inmates who participated in the program to those who now are on the grounds maintenance crew. These inmate instructors diagnose and treat common plant problems found on the grounds and are responsible for identifying appropriate plants to use in the landscaping plans proposed by the facilities administration. Their role is much the same as landscapers who respond to the needs of a client with recommendations and suggestions based on the knowledge gained in the original horticultural vocational program which was in place at Augusta. They work with a C.O. who is a self taught horticulturalist with other peripheral experience.

The turf management and pruning skills the inmate/instructors acquired through the original vocational program and which they pass on to the rest of the crew are sought after in the community. And some inmates have made the transition to post-release horticultural jobs. The population is changing. Before there were more inmates who had some experience of planting. Now as the urban areas of Georgia grow, the inmate population is increasingly less experienced in planting. Still some inmates do have farm experience, and are familiar with power tools and tractors which they use under the supervision of Correction officers.

Interestingly there are no requirements set on those who would like to be on the landscape crew other than interest in horticulture and physical ability to participate by following directions and understanding the reading material. Though there is no formal classroom component to the landscape crew's training they are provided with books and catalogs to study from. The facility is classified as maximum security, but the majority of inmates are medium security. The crew is drawn from the general population only. In the early 90s there was a gardening program for the mental health population which was run by the facilities activities instructor. Each inmate had an area that they were allowed to cultivate as a vegetable garden. The participants gave the produce to the kitchen that prepared the food for those inmates in the mental health wards. Drew believes the enjoyed and benefited by the simple work of planting, watering and weeding, though many never worked in gardens before. They used hand and tools to do their work and the program which was sustainable and self-sufficient and required a minimal budget, which was more than justified by the quality of the results obtained in job satisfaction, increased self-esteem and food production.

For info contact:

Ron Whittaker, Deputy Warden, Care and Treatment  
Augusta State Medical Prison  
3001 Gordon Hwy  
Grovetown Georgia 30813  
(706) 855-4782



# Chapter 12: The Names of Plants

*I cannot tell what the Dickens his name is.*

— The Merry Wives of Windsor

***“Without names we cannot design gardens or determine whether or not a particular plant will do well in a particular site... Without names we cannot speak the language of the plant”***

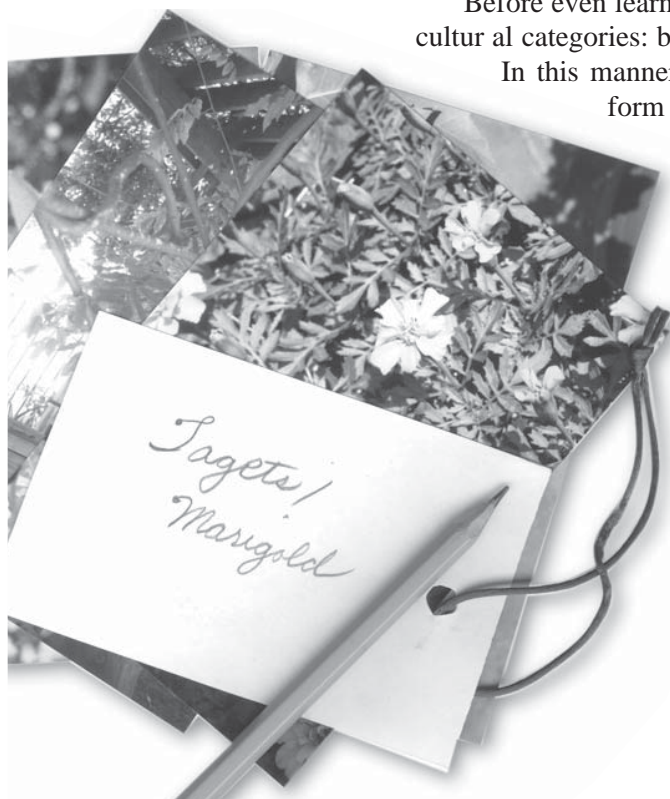
## THE IMPORTANCE OF NAMES

Perhaps the hardest and most important challenge in teaching horticulture is familiarizing students with the names of plants found in the garden. What's in a name? Everything. We like to tell students that their expertise in horticulture will greatly depend on how well they can identify and name different plants, not only by their common and Latin name, but where appropriate, the names of plant varieties. In learning names, we can learn about the plant's attributes, its origins, its beneficial uses and the kind of care it needs to be healthy. Without names we cannot design gardens or determine whether or not a particular plant will do well in a particular site. We won't know when to prune, how long the plant will flower, whether to deadhead or divide, or whether it will come back the following year. Without names we cannot speak the language of the plant.

Before even learning the names of plants, we divide plants into their horticultural categories: bulb, annual, perennial, shrub, tree, vine and groundcover.

In this manner students can begin to associate plants with their basic form and structure. The next step is to teach the names of a few common garden plants by having students physically identify and plant that particular species. What is its leaf shape, the color or scent of its flowers, the color of its bark or shape of its outline?

The act of planting and the plant's subsequent care – water, mulch, or rudimentary pruning, helps create both an intellectual and emotional connection to the plant. This in turn helps students retain the plant's name together with its fundamental role in the garden. Over time students will begin to accumulate a bank of names and associations that will be part of their work experience. Learning plant names is equivalent to learning a language. It cannot be intellectualized, but must be used as an on-going dialogue between students and their daily work activities.



## Carl Linnaeus – Swedish Botanist

As a botanist of the 18th Century, traveling Europe in search of new species of plants, Carl Linnaeus (1707-1778) faced a constant problem: plants referred to by different names in different regions were the same species. How to differentiate plants by their name in a language common to botanists from around the world was a challenge he took on by developing the binomial nomenclature classification system using Latin as a common language.

Linnaeus broke down his system into family, genus and species, which grouped plants together based on common characteristics. Because flowers for a large part determine the reproductive system of the plant, Linnaeus used the genus as the smallest group containing related but separate species; genera do not necessarily interbreed. The species refers to plants of a group which breed true generation after generation. Variety is a species that has a characteristic different from the species group it belongs to, while a hybrid is a cross between species that are generally sterile and will not produce offspring.

Often the species name characterizes a certain aspect of the plant, or it can carry the name of the person who first described it and named it in published form.



## ANNUALS

Annuals are herbaceous plants that germinate, mature, flower, produce seed and die in one growing season. Because their time on earth is short, annuals channel their energy into flower and seed production and less energy into the development of roots and leaves. They:

- \* Grow quickly but last all summer
- \* Bloom in less than 8 weeks from the time the seed is planted
- \* Easy to grow and adaptable to different conditions
- \* Provide a continuous bloom

Annuals create an instant splashy garden or make excellent borders, fillers between perennials and are popular in planters and window boxes.

### Important terms associated with annuals

**Hardy annuals** tolerate frost and self-sow.

**Half-hardy annuals** can tolerate light frosts, and seeds can be planted early.

**Tender annuals** are usually tropical or subtropical plants. The largest category of annuals, they can be easily killed by frost.

**Tender perennial** is a plant that easily survives year after year in tropics but acts like an annual in temperate zones.

### Here are a few common annuals for a variety of gardens

Lantana camara/Lantana	fragrance garden
Petunia x hybrida/Petunia	fragrance garden, bird and butterfly gardens
Ocimum basilicum/Basil	edible herb, fragrant
Pelargonium spp/geranium	fragrance garden
Tagetes spp./marigolds	fragrance garden, good companion plant for vegetable garden, bird and butterfly gardens
Verbena x hybrida/Verbena	fragrance garden
Nicotiana spp./Nicotiana	fragrance garden
Lubularia maritima/Sweet alyssum	fragrance garden
Brassica nigra/Wild mustard	herb garden
Tropaeolum majus/ Garden nasturtium	herb garden, good companion plant for vegetable garden, bird and butterfly gardens
Portulaca oleracea/Purslane	herb garden
Plantago coronopus/Herba stella	herb garden
Matricaria recutita/chamomile	herb garden, fragrance garden
Helianthus annuus/American sunflower	herb garden, bird gardens
Amaranthus caudatus/Chinese spinach	herb garden (staple of chinese cookery)
Antirrhinum majus/Snapdragon	bird and butterfly gardens
Impatiens walleriana/Busy Lizzie	bird and butterfly gardens
Lantanas spp./Lantana	bird and butterfly gardens
Mirabilis jalapa/Four o'clock	bird and butterfly gardens
Portulaca grandiflora/Moss rose	bird and butterfly gardens
Zinnia elegans/Zinnia	bird and butterfly gardens
Escholzia californica/California Poppy	good for dry conditions
Gysophilia elegans/Sunflower	good for dry conditions
Oenothera biennis/Evening primrose	good for dry conditions
Limonium sinuatum/Statice	good for dry conditions
Papaver somniferum/Opium poppy	
Mirabilis jalapa/Four o'clock	good for dry conditions
Senecio cineraria/Dusty Miller	good for dry conditions
Verbena spp./Verbenas	good for dry conditions





**Coleus/*Coleus* spp.**



**Impatiens/*Impatiens Wallerana***



**Marigold/*Tagetes* spp.**



**Flowering Tobacco/*Nicotiana glauca***



**Zinnia/*Zinnia* spp.**

## Perennials

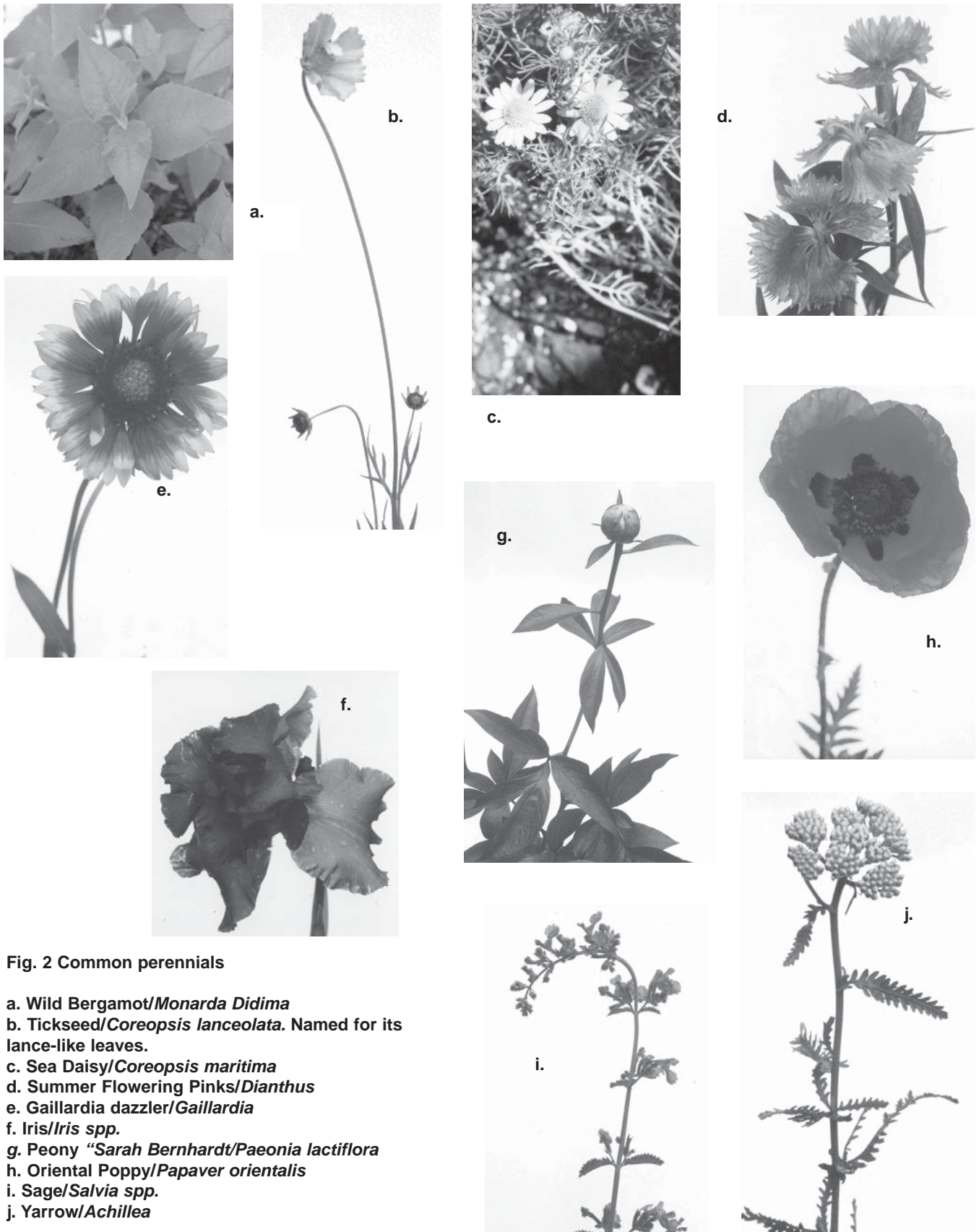
Perennials are a wide variety of herbaceous plants that come back each year following a dormant period when they die back to the ground in winter. At first, the plant's energy is channeled into an extensive root system which stores food in the winter, and sends up new shoots as the weather turns favorably warm in spring. After the second year, perennials tend to increase in size, and after some time can be uprooted and divided. Other traits of perennials include:

- \* Tends to grow more slowly than annuals as the plant first devotes energy to establishing its root system
- \* Depending on the species, they can have short or long bloom periods.
- \* By species they can be deadheaded for continuous blooms (many perennials have only one bloom.)
- \* Often easy care and tolerant of harsh conditions
- \* Can be divided.

### Common Perennials – many native – for a variety of gardens

Achillea millefolium/Yarrow	Herb gardens, dry gardens with poor soil
Agastache foeniculum/Anise Hyssop	Butterfly gardens
Aquilegia formosa/Western columbine	Butterfly gardens
Asclepias tuberosa/Butterfly weed	Good for dry gardens, Butterfly gardens
Astilbe spp/Astilbe	Shade gardens
Coreopsis lanceolata/Coreopsis - Tidkseed	Butterfly gardens, Dry gardens
Echinacea purpurea/Purple coneflower	Butterfly gardens, Herb garden, Low maintenance gardens, Grassland gardens
Galium odoratum/Sweet woodruff	Herb garden
Geranium Maculatum	Low maintenance gardens, shady gardens
Heliotropium arborescens/Purple heliotrope	Moist container gardens
Hosta spp/ Hosta	Tolerates shade
Hylotelephium spectabile/Sedum	Butterfly gardens
Lavandula angustifolia/Lavender	Herb gardens
Leucanthemum vulgare/Daisy	Sunny gardens with average soil
Liatris spicata/Liatris	Late summer bloom for sunny moist gardens, North American grassland gardens
Limonium sinuatum/Statice (half-hardy biennial)	Hot dry sandy gardens, Cut-flower garden
Lupinus/Lupine	Partial shade garden, cool and moist, Butterfly garden
Mentha spp./Mints	Herb gardens, gardens with poor soil, low maintenance gardens
Monarda didyma	Sunny gardens, average soil, Herb gardens
Rosmarinus officinalis/Rosemary	Herb garden
Rudbeckia hirta/Black-eyed Susan	Low maintenance gardens, hot dry gardens, North American grassland gardens
Salvia officinalis/Sage	Herb gardens
Verbena bonariensis/Verbena	Butterfly gardens
Thymus vulgaris/Thyme	Herb gardens





**Fig. 2 Common perennials**

- a. Wild Bergamot/*Monarda Didima***
- b. Tickseed/*Coreopsis lanceolata*. Named for its lance-like leaves.**
- c. Sea Daisy/*Coreopsis maritima***
- d. Summer Flowering Pinks/*Dianthus***
- e. Gaillardia dazzler/*Gaillardia***
- f. Iris/*Iris* spp.**
- g. Peony "*Sarah Bernhardt*/*Paeonia lactiflora***
- h. Oriental Poppy/*Papaver orientalis***
- i. Sage/*Salvia* spp.**
- j. Yarrow/*Achillea***

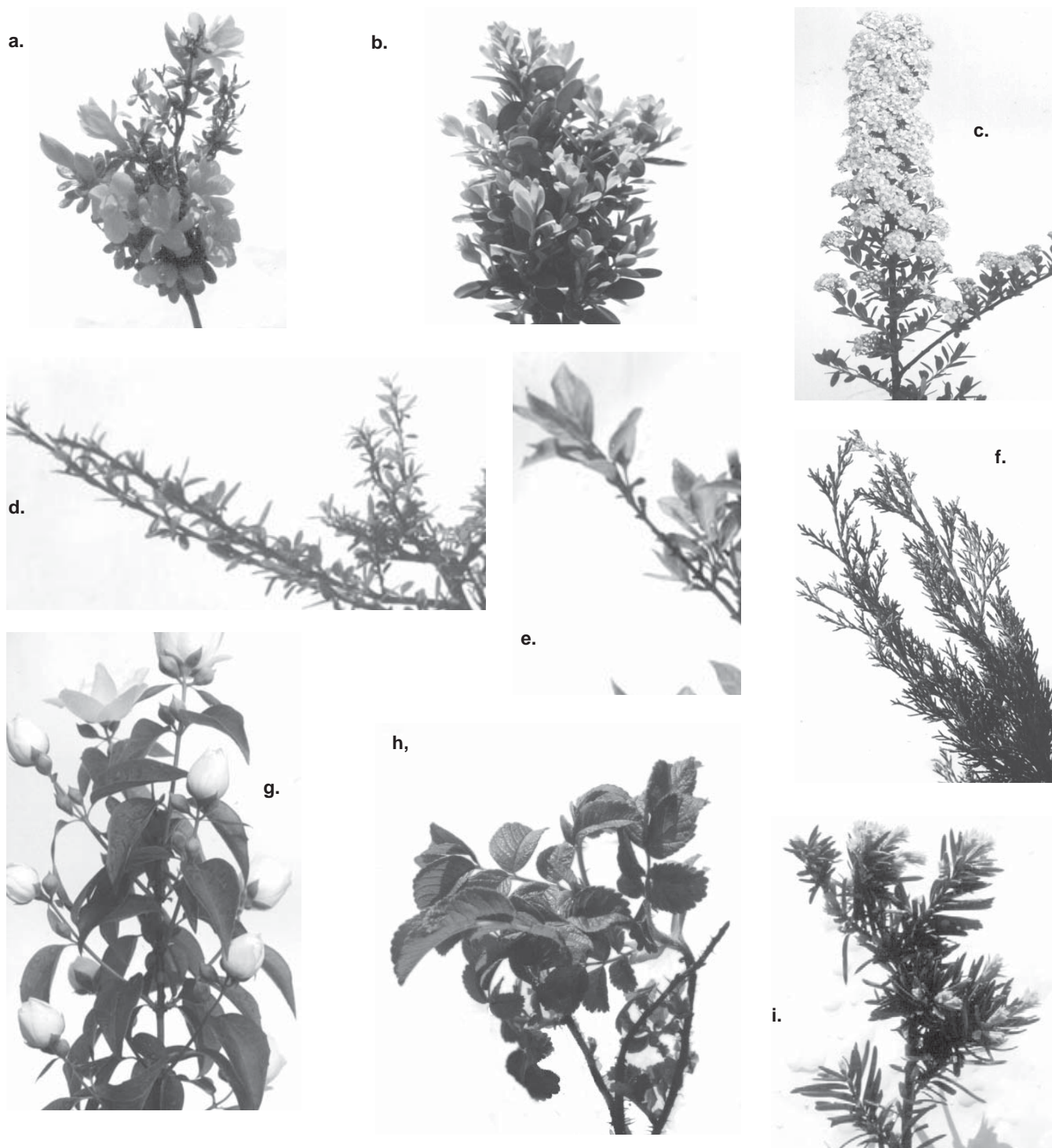
## Shrubs

Shrubs are generally multi-stemmed woody plants that rarely grow over 25 feet tall. Shrubs can provide hedges and windscreens as evergreens, make excellent foundation plantings, offer a mid-layer structure to the garden and provide food and habitat to a variety of birds, and animals. Different types include:

- \* Evergreen as broadleaf or conifer
- \* Flowering in fall, spring or summer
- \* Strong foliage as a screen or hedge

**Shrubs may be deciduous, evergreen, or semi-evergreen with needles; broadleaved like rhododendron or with scaly narrow leaves like juniper or false cypress. Shrubs have multiple stems and tend toward pyramidal, columnar, arching, rounded, or low growing shapes. They can range in height from a few feet to over 30 feet. When a shrub has been trained to a single stem it is called a standard, and resembles a miniature tree.**

Berberis spp./Barberries	Berries are bird habitat, summer and fall foliage
Boxus/Boxwood	Evergreen, border planting
cornus sericea/Red-osier dogwood	Flowers in spring, red bark
Cotinus coggygria/Smoke tree	Striking foliage and flowers
Cotoneaster horizontalis/Cotoneaster	Berries are bird habitat, drought resistant
Forsythia intermedia/Forsythia	It's yellow flowers are a sign of spring, massed planting or hedge
Euonymus altata/Burning bush	Striking fall foliage
Hydrangea quercifolia/Oakleaf hydrangea	Flowers dry on the stems for winter color
Mahonia spp./Mahonia	Evergreen, berries are bird habitat
Rosa rugosa/Coast rose	Drought resistant, tolerates sandy soil
Rhododendron/Rhododendron	Striking flowers
Taxus/yew	Evergreen, berries in winter
Thuja/Arborvitae	Tolerates shade



**Fig. 3. Some common shrubs**

- a. Azalea “rose bud”/*Rhododendron***
- b. Boxwood/*Buxus sempervirens***
- c. Bridal veil/*Spirea nipponica***
- d. Cotoneaster/*Cotoneaster horizontalis***
- e. Forsythia/*Forsythia x intermedia***

- f. Juniper/*Juniperus spp.***
- g. Mock Orange/*Philadelphus spp.***
- h. Coast rose/*Rosa rugosa***
- i. Yew/*Taxus***



## THE STORY OF ROSES

Though considered a shrub (or sometimes a vine) roses are really in a category all to themselves. Fossils of the rose point to their appearance on earth some 30 million years ago. And humans began cultivating in the imperial gardens of the Chou Dynasty around 500 BC. The Romans brought the rose to its prominent role in civilization during the peak of their empire, where it was celebrated at festivals, its petals carpeting the homes of wealthy citizens. Greenhouses were built with piped-in heat, providing year round blossoms for the rich.

Through the ages roses were celebrated in art and poetry. The luxury and fragrance of a rose framed by the thorns on its stem served as apt metaphors in art and politics. Rose oil was used by different civilizations to anoint the dead, and create perfumes. In medieval France, commoners were only allowed to experience the oil on their wedding day. By the 18th Century, petals from *Rosa gallica*, the apothecary rose, were applied in a majority of herbal remedies. While mostly the petals were consumed, the rose hip has a high concentration of vitamin C and is used today as additives in a number of commercial health drinks and medicines. The thousands of varieties found today are actually derived from only about 7 to 8 wild species, mostly from Asia, which were crossed over and over, creating a multitude of colors, fragrances and shapes that is known as the hybrid tea class.

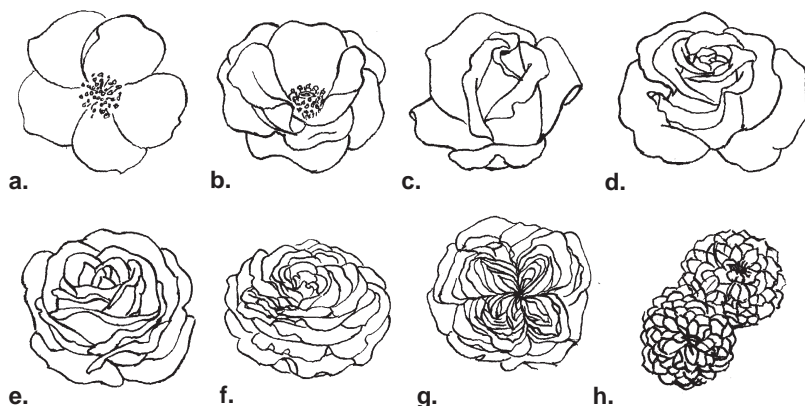


Fig. 4. There are 8 distinct flower shapes of roses:

- a. Flat, open
- b. Cupped, open
- c. Pointed. Tea roses are in this class.
- d. Urn-shaped, curved and flat topped.
- e. Rounded, petals overlap evenly
- f. Rosette flattish, many confused overlapping petals
- g. Quartered rosette, like a quartered Rosette.
- h. Pompom, small rounded double or fully double petals.

### A rose is a rose

These prickly stemmed, flowering shrubs can be divided into four major types:

#### Bush Roses

There are seven types of bush roses:

- \* **Hybrid tea roses** are 3 – 5 feet tall and bloom repeatedly throughout the summer.

- \* **Polyantha** are hardy and easy to grow. They flower abundantly in large clusters.

- \* **Floribunda** are crosses between hybrid tea roses and polyantha. Hardy and easy to grow, bloom throughout the season.

- \* **Grandiflora**, 5 – 6 feet tall, these plants bear long stemmed flowers summer to fall.

- \* **Miniature roses** give scaled-down blooms freely throughout the season.

- \* **Heritage roses** first appeared in 1867. Some bloom once others repeatedly. Mosses, portlands, gallicas, bourbons, centifolias, and damasks are common.

#### Climbing roses

Climbing roses are represented by large, flowered climbers on thick canes up to 10 feet tall, and the ramblers on thin canes of up to 20 feet tall. They bloom in the spring.

#### Shrub Roses

These upright roses grow to a height of 4 – 12 feet and have numerous arching stems. Some bloom repeatedly others bloom but once.

#### Groundcover roses

These once blooming or repeat blooming roses lie upon the ground and spread in low mounds.

## ORNAMENTAL GRASS

More landscape designers are employing ornamental grasses in their gardens. Fast-growing, and retaining clump forms (unlike lawn grass which moves out on horizontal rhizomes) ornamental grasses provide a wide range of texture and form to the garden. Varieties such as miscanthus, pampa and penisetum, send up large plumes in the fall and retain their form all winter. Other attributes include:

- \* Tolerant of harsh wind and dry conditions
- \* Based on size, provides fast-growing architectural screening
- \* Provide 4 season interest in the garden
- \* Softens the landscape with feathery texture
- \* Can be divided and replanted



Fig. 5. *Miscanthus/Miscanthus sinensis*

## BULBS

Bulbs are an underground food storage organ – similar to an onion – that generate flowers without developing much foliage. Bulbs typically are planted in the fall for early spring bloom. While some plants appear to be bulbs, they are actually tubers (a potato or dahlia) or corns like a gladiola. Even the fleshy rhizome of the iris is often mistaken for a bulb. The more common flowering bulbs are crocuses, tulips, daffodils and allium. Within these species there are thousands of varieties offering specific colors, shades, shape, size and form. All types of bulbs have an important role in the garden for the following reasons.

- \* Crocuses are generally the first to flower and are a colorful harbinger of spring.
- \* Different bulbs flower at different times and can be space, tightly together offering successive waves of blooms.
- \* Can be planted under trees (that in summer are too deeply shaded for flowering plants because they flower well before the overhead foliage leafs out.
- \* Are low maintenance.
- \* Some bulbs act as perennials and naturalize in the garden, while others like tulips can be dug up, stored and replanted.



Fig 6. Some common flowers grown from bulbs.

a. Daffodils/*Narcissus spp.*

b. Tulip/*Tulipa spp.*



## TREES

Trees are single-stemmed (sometimes in clump form such as birch and serviceberry) woody plants that cover a wide range of uses, form and structure in the landscape. Once established trees are more difficult to transplant and should be used judiciously in the prison landscape. See arbor chapter 9.

**Maintaining tree health in an urbanized environment is a growing and challenging field. There is a lot of information on new developments in monitoring tree diseases and diagnosing environmental stress being disseminated through governmental and educational bodies. With the emphasis on urban forestry and arboriculture in many large cities, there are seasonal employment opportunities available that are worth pursuing.**

**Below are some small trees known for either striking foliage, flowers, or exceptional hardiness.**

Cercis canadensis/Eastern redbud	Pink flowers
Cercis chinensis/Chinese redbud	Magenta flowers
Magnolia stellata/star magnolia	White to pink flowers
Magnolia soulangiana/saucer magnolia	White to wine flowers
Cornus florida/Flowering dogwood	Big white star-shaped flowers
Pyrus calleryana/Callery pear	white flowers
Syringa reticulata/Japanese tree lilac	white flowers
Lagerstroemia indica/crepe myrtle	White, pink and lavender flowers
Acer campestre/Hedge maple	Can tolerate high pH/drought
Acer ginnala/Amur maple	Can tolerate high pH
Amelanchier canadensis/Serviceberry	
Acer truncatum/Shantung maple	Fall foliage
Crataegus crus-galli/Thornless Cockspur Hawthorn	Can tolerate drought
Maackia amurensis/Amur Maackia	
Prunus virginiana/Schubert cherry	Drooping rows of small white flowers
Sorbus ainifolia/Korean Mountain Ash	Drought resistant, flowering
Syringa reticulata 'Ivory Silk', 'Summer Snow'/Japanese tree lilac	Drought resistant, flowering
Styphnolobium japonicum/Scholar tree	Drought, salt, and compaction resistant



**Fig. 7. Common fruit and flowering trees that grow to a height of less than fifty feet.**  
**a. Serviceberry/***Amelanchier canadensis*  
**b. Apricot/***Prunus armeniaca*  
**c. Birch/***Betula spp.*  
**d. Cherry/***Prunus spp.*  
**e. Flowering dogwood/***Cornus florida*  
**f. Magnolia/***Magnolia spp.*  
**g. Nectarine/***Prunus nectarina*  
**h. Smoke tree/***Cotinus coggyria*

## VINES

Vines provide vertical structure to the garden along trellises and buildings, on fences, pergolas or a simple sculpted pole, utilizing space that is unavailable to other plants. Vines can be woody, herbaceous, evergreen or deciduous, and add exquisite details to your garden structures. Vines should be chosen judiciously.

Remember, over time, as they mature, vines can hold in moisture and keep air out causing structures made from wood to rot. Vines such as wisteria, hydrangea and grape can become quite heavy and do considerable damage to weak structures. For these particular plants, an additional support system may be recommended such as a metal bars or 10-gauge (or heavier) wires.

Vines, which grow and climb with aerial roots and by means of holdfast suckers, often leave troublesome marks on walls and have to be laboriously scraped if the wall needs repainting. However, with the right species in the right place, any problem associated with vines can be easily avoided. The role these plants have in the landscape far outweigh their potential for damage. Their attributes are as follows:

- \* Vine species do well in shade and hot weather.
- \* Once established they are fast growing and low maintenance.
- \* Can produce vegetables for humans, berries for birds and nectar for hummingbirds and butterflies.
- \* Provide living cover for pergolas and outdoor shade structures.
- \* Will screen unsightly walls, pipes or structures.

### Some vines and the way that they climb

Hedera helix/English ivy	Adhesive rootlets
Lathyrus odoratus/sweet peas	Wrapping tendrils
Parthenocissus quinquefolia/Virginia creeper	Tendrils with adhesive discs
Wisteria spp./wisterias	Entire stem wraps around support
Rosa/climbing rose	Must be secured with string



a.



c.



b.



d.

**Fig. 7. Common vines.**

**a. Wisteria/Wisteria floribunda**

**b. English ivy/Hedera helix**

**c. Morning glory/Ipomoea**

**d. Virginia creeper/Parthenocissus quinquefolia**



## GROUND COVER

Groundcover creates the ground layer of the garden's structure by staying low to the ground – 18 inches or smaller – and spreading rapidly. Groundcovers can be evergreen or die back in the winter, sun or shade loving, flowering or simply foliage. Ivy, (helix spp.), liriopse, strawberry, and bugleweed (ajuga), junipers (juniperus spp) are a few common groundcovers useful in the garden. Some of the important attributes of these plants are:

- \* Provides a living mulch that will suppress weeds and help bind the soil.
- \* Are generally lower maintenance than lawns.
- \* Creates interest in hard to plant areas such as under shade trees, on steep slopes, along steps or rocky ledges providing flowers or foliage.
- \* Can stem erosion.

### Exercise 1

#### Plant Identification (an instructor led workshop)

##### Materials:

- \* Pruners
- \* Camera
- \* Index cards with a hole punched in them
- \* String
- \* Looseleaf folder with plastic sleeves
- \* Pens

##### Procedure:

- \* The instructor first makes photos from cuttings of plants in the garden as they enter their most characteristic stage of development. Photograph cuttings against a piece of white paper
- \* The photos may be identified by the instructor either with their Latin name or common name on the backs of the photos.
- \* Students then research and fill in either the Latin name or the common name as necessary and include it on the back of the photo.
- \* Selecting a few photos at a time and match them to the plant in the garden. Everyone should have a chance to identify all the pictured in the photos.
- \* After correctly identifying a particular the students can write out a label and fix it to the plant with string.
- \* Collect the photos into a looseleaf binder along with research about the particular plant's habits and culture.



## GENUS AND SPECIES

Understanding a little bit of Latin goes a long way in associating plant names to their general features. Calling plants by their Latin names tends to separate the “professional” gardener from the weekend hobbyist.

While genus names are simple memorization and the continuous use of plants by that name, species names are more descriptive and can be used to describe particular traits or features. The following chart is an example of some of the more common species names and their specific English meaning.

### LATIN TERMS

#### Size, appearance or texture

alatus - winged  
albus - white  
arborescens - treelike, woody  
argenteus - silvery  
atro dark  
aurantifolius - golden leaved  
aureolus - golden  
aureus - sky blue  
candicans - white blue  
cardinalis - red  
carneus - flesh colored  
cereus - waxy  
chryso - golden  
citrinus - lemon yellow  
cocineus - scarlet  
columnaris - upright  
cristatus - crested  
cyan - blue  
elatus - tall  
erectus - upright  
erio - wooly  
flavus - yellow  
fulvus - tawny  
glabra - smooth  
griseus - grey  
hirtus - hairy  
imperialis - tall  
lacta - milky white  
laevis - smooth  
leptocaulis - thin stemmed  
leuco - white

melano - black  
meleagris - speckled  
minimus - very small  
mucosus - slimy  
multicaulis - multi-stemmed  
nuscous - mossy  
nanus - dwarf  
niger - black  
nitidus - shining  
nivalis - white  
pallidus - pale  
papillosus - with warty protuberances  
parvulus - very small  
parvus - small  
pubescens - downy  
pumilus - dwarf  
prupurascens - becoming purple  
purpureus - purple  
roseus - rosy  
ruber - red  
versicolor - varicolored  
virens - green  
xanthus - yellow

#### Flower type

asteroides - star-like  
botryoides - clustered  
brachanthus - short flowered  
floribundus - free flowering  
oxypetalus - sharp petaled  
stellata - starry

#### Leaf Type

acaulis - stemless  
alternifolius - alternate leaved  
angustifolius - narrow leaved  
brevifolius - short leaved  
latifolia - broad leaved  
leptocaulis - thin stemmed  
lobularis - lobed  
longispinus - long spined  
monophyllus - single leaf  
ovatus - oval  
palmatus - palm shaped  
pennatus - feathered  
plumosus - feathery  
rugosa - wrinkled  
tenuifolius - slender leaves

#### Fragrance

foetidus - foul smelling  
fragrans - fragrant  
moschatus - musky  
suaveolens - sweet scented

#### Habitat or Function

aestivus - blooming or ripe in summer  
annuus - annual  
autumnalis - autumn  
bacatus - berried  
bulbifera - bulb bearing  
cernuus - drooping, nodding  
coccigera - berry bearing

edulis - edible  
flexilis - pliant  
fruticans - shrubby  
horizontalis - low to the ground  
humilis - low-growing  
macrocarpa - large-fruited  
mamalis - of may  
noctiflous - nut-bearing  
officinal - medicinal  
patens - spreading  
pendulus - hanging  
procumbens - lying down  
radicans - rooting  
repens - creeping  
scandens - climbing  
vernalis - of spring

#### Habitat or source

aquaticus - aquatic  
chinensis - of China  
japonica - or Japan  
montanus - of the mountains  
palustris - marsh loving  
pratensis - of meadows  
salsuginosus - found in salt marshes  
saxatilis - found among rocks

## Chapter 13: Garden Structures and Construction

*To every thing there is a season  
and a time to every purpose under heaven:  
...a time to break down,  
and a time to build up.*

***“My time is over here in 17 days. This year has gone by like one extremely positive minute. I firmly believe I could not have done time in a more productive way.”***

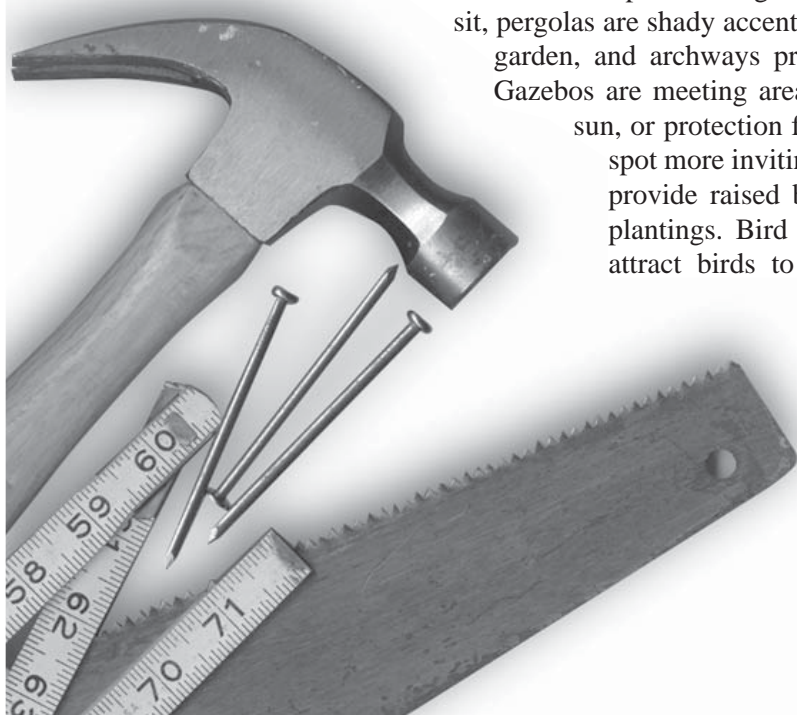
**John Pierog - inmate**

It is summer. Imagine a wooden gazebo nestled in a perennial garden with a stone waterfall flowing off its side into a pond stocked with fish and turtles. Butterflies from monarchs to swallowtails dip lazily by the splash of water off the rocks. There is the sound of nature as the water hits the pool. Perhaps this sounds more like paradise than prison. For inmates at Rikers, the gazebo garden is paradise, but it is the inmates' work and product that helped transform the island's bleak surroundings into a landscaped Eden. The benefits are more than just moments by the pond, or a relaxing break in the gazebo. Students leave jail with a greater sense of their own possibilities as they experience the tangible impact of hard work, skilled labor and creative design.

Structures in the garden often balance the transitory and dynamic fluxes of plant growth and seasonal change with solid bearing. Structures anchor the garden to a human space and presence. They can be as complex as a gazebo or pergola or as simple as a birdhouse and feeder. They can be frivolous, like sculptures or totem poles, or practical, like compost bins and planter boxes.

Structures help define a garden with focal points. Benches mark places to sit, pergolas are shady accents that can act as bridges or runways to another garden, and archways provide entrances to an outdoor garden room. Gazebos are meeting areas inside the garden, offering shade from the sun, or protection from rain. Benches around trees make a shady spot more inviting. For concrete or asphalt areas, planter boxes provide raised beds for perennial, herb, vegetable or annual plantings. Bird feeders give vertical structure and of course attract birds to the garden. All of these structures can be designed and built in the prison garden.

The value of structures—their design and construction—provides students with the opportunity to learn strong carpentry skills, to hone a trade and impart those skills to other inmates. Often this evolves as an informal process that highlights the poignancy of group dynamics.



Two simple garden structures requiring only 2"x4" timbers for their construction

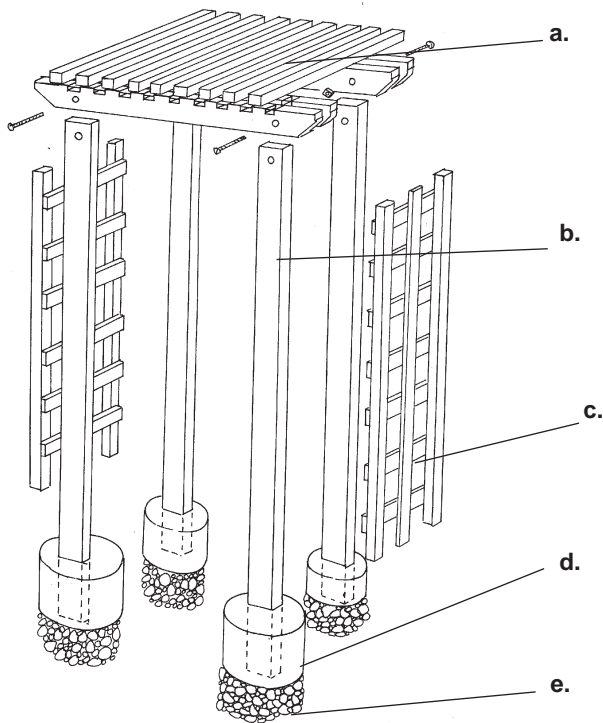


Fig. 1. Garden arch with trellis

a. The roof of the arch is made from 2"x4" timber ripped down to 2"x2".

b. The uprights are made from 2"x4" timber. A track is created along the inside edge to hold the trellis.

c. The trellis is made from 2"x1/4" lath also ripped down.

d. Concrete is poured to make the uprights stable after leveling them vertically with the use of stakes and strings.

e. After digging the holes fill with 4-6" of gravel, make the gravel level using stakes and string. That way it will be easy to level the arch horizontally.

Fig. 3. Home-made Tablesaw

At first, Greenhouse program staff members brought their own tools to the jail house. When that was not possible, the students built their own table saw from a skill saw, some scrap plywood, and a few 2"x4" timbers. The saw was used to create many of the garden structures used at *Zona Verde*. Eventually a sponsor stepped forward and donated better power tools, including a table saw and a band saw to the program.

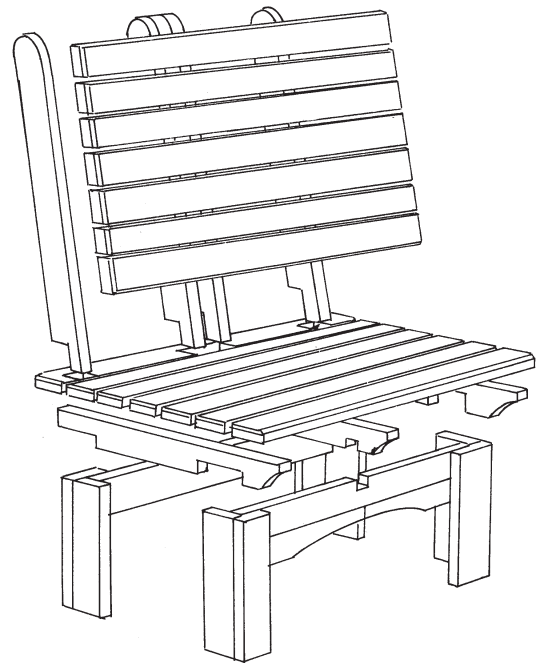


Fig. 2. Benches are fun to make and easy to design.

This bench uses only 2"x4" timber. It can be made with or without a back. Benches like this were part of a co-op project with *The Horticultural Society of NY Apple Seed* elementary school horticulture/science program's rooftop garden project called *Zona Verde* and the *Greenhouse* program at Rikers Island. Benches encourage gardeners to remember the garden is also a place to relax and enjoy the fruits of their labor.



### **JOHN PIEROG (inmate carpenter and gazebo/pond builder)**

My name is John Pierog and I've been a carpenter for 30 years. For the past year I have been incarcerated at Rikers Island and involved with building a gazebo and pond through the horticulture program. Most of the inmates involved with the project had no formal training in carpentry, plant life or pond construction. But we were open-minded and willing to work and learn.

The original idea for this project stemmed from an existing concrete hole in the ground at the greenhouse. Our choices were to bury it, or come up with an idea to use while incorporating some element of horticulture. After some discussion we decided to make a bog with water plants. This concept grew into a pond, then a pond with a waterfall, and finally a 12 ft x 10 ft semi-square gazebo with a waterfall running out from underneath it into the original concrete hole in the ground. This would then over-spill into an approximately 14-foot diameter pond which would sustain fish and plant life through man-made, yet natural conditions.

Almost all of the materials we used were scrap we found on the island. The instructors purchased other materials such as shingles for the gazebo roof and the pond's rubber lining and pumps to circulate water from the pond to the waterfall.

I designed the gazebo and waterfall but we all learned from each other as design turned into the actual project. Several inmates worked alongside me and I taught them what I knew about construction. By the end of the project they were instructing and supervising other inmates on rock masonry, pond sculpture, water flow control and plant selection.



We were all thrilled with the project; and it taught something to all of us, including this carpenter with 30-years experience. I learned much about plants and water plant life and about incorporating my work – carpentry – into horticulture. I was also thrilled to be able to teach some of my skills to other young inmates who were hungry for the knowledge. My time is over here in 17 days. This year has gone by like one extremely positive minute. I firmly believe I could not have done time in a more productive way.

**Fig. 4. John Pierog.**

**John learned as much about the difficulties and rewards of being a teacher as the younger, less experienced students learned about wood-working during the gazebo project. And everyone learned something about water plants, including some of the instructors and officers.**

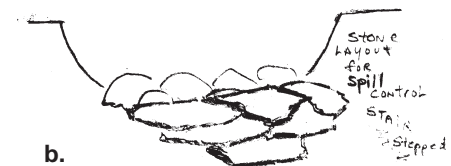
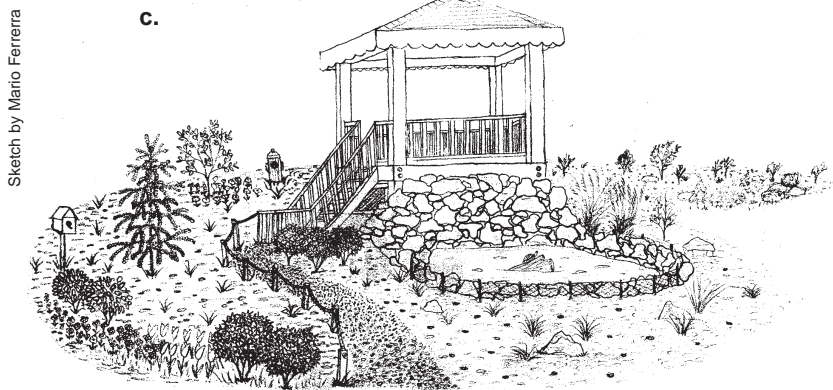
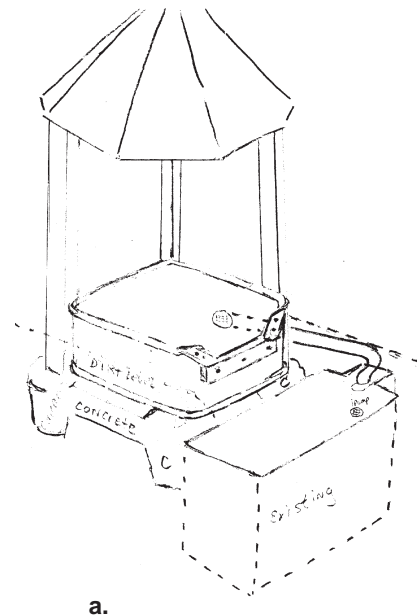


**Fig. 5. The development of the gazebo and pond design**

a. The original sketch for the design shows a modest structure built alongside an existing concrete trough. The concept was the result of a brainstorming session among the students.

b. The intention was to convert the eyesore into a feature. The plan was to naturalize the obsolete manmade structure by using as many natural elements as possible. Local stones gathered on the island were used to camouflage the spillway. The students drew on structures they had seen in gardens, magazines as well as natural scenes.

c. A much later drawing of the gazebo pond area shows how the idea grew into a much more ambitious project more in scale to the surrounding gardens. The beginnings of landscaping is hinted at in the sketch.



**Fig. 6. The gazebo as it looks today.**

There are many kinds of plants for water gardens. Some these bog and marsh plants like to keep their feet wet. Other s are floating plants. Animals like Japanese koi and indiginous turtles feed on insect larvae in the water.

Water gardening, maybe more than other kinds of gardens challenges the student to study and simulate nature to create an eco-system in miniature. Almost every animal, bird, and insect in the garden will ultimately visit the pond, especially the humans.



### Plants for Balance

Submerged plants such as *Myriophyllum aquaticum*, help oxygenate the water and compete with algae preventing them from taking over. Too many submerged plants clog up the pond and make conditions difficult for floating plants.

Floating plants such as *Nymphaea* spp are effective at shading and prevent sunlight-loving algae the chance to proliferate. Too many surface plants block sunlight for submerged plants, causing them to die and decompose. This can damage the chemical balance of the pond and turn it black and smelly.

Japanese koi are extremely well adapted to pond conditions and offer size and color. Throw in a few bottom feeders to help clean algae and other waste materials for additional cleaning. A turtle log in the center allows your terrapins to bask in the sun in a secure and observable space.

## USING ROCK AND WATER

### Pond Construction

Ponds create a dynamic feature in the garden landscape: a water ecosystem brimming with fish, plants and turtles is a system that invites scientific inquiry. How to make the pond a self-sustaining, self-cleaning system using plants as natural filters. How do plants take up nutrients expelled as waste from pond animals? How to promote breeding among fish, or propagate water plants?

Constructing a pond is as simple a matter of digging a well-formed hole and deciding whether you want to use a pre-formed pool or using a pond liner to fit the shape of your system. We recommend the pond liner. Not only is it less expensive, but also allows you to more flexibility and change in your design. The slope should have shelves to place potted water plants that will filter much of the expended waste of your fish and turtles. The complications arise as you try to find the balance between fish and plants to keep the pond from mucking up with silt and algae. There is no standard remedy but a few steps can go a long way to finding the right balance to a healthy and productive sys-



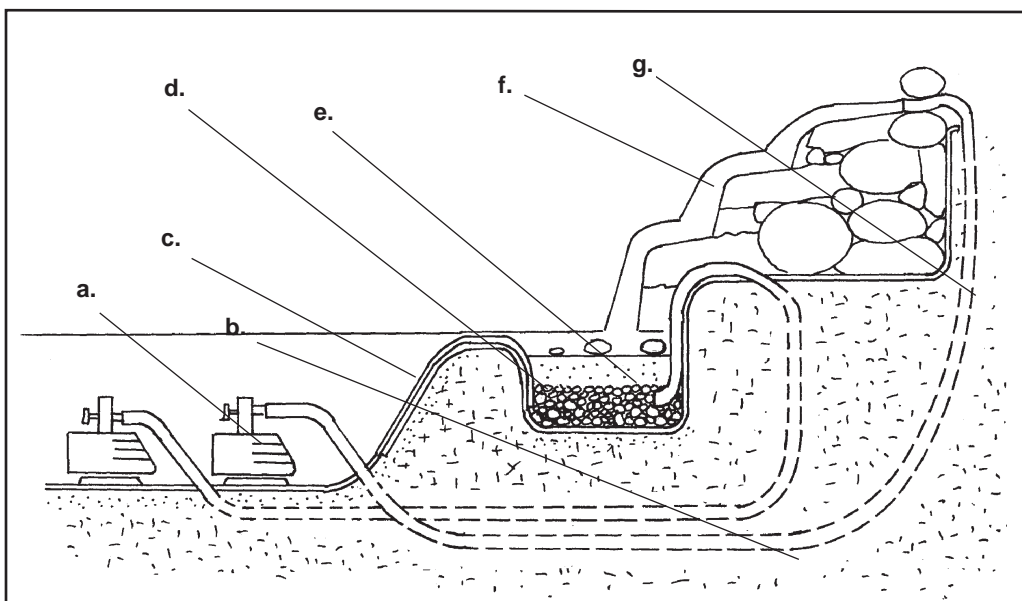
**Fig. 7. The pond as ecosystem.**

Many of the plants used to landscape the area around the waterfall and pond came from donations from nurseries. Willows were propagated in the greenhouse from stem cuttings in the fall and planted in the spring. Short and tall grasses are a natural choice for the area around the pond. Small flowering trees like magnolia and lilac give spring color.

Keep your water garden manageable, with enough space for floating plants, turtles and fish. The pool must be at least 18 inches deep. From the mid Atlantic states north, deeper is better, keeping in mind you will have to get into the pond to plant. A pool with a diameter of twelve feet should be able to remain filled with water throughout the winter and still support fish.

## Building the Waterfall

With a few rocks, rubble and an \$90 pump you can have a waterfall as an addition to your system. Not only does the splash zone help oxygenate the water and help prevent the build-up of algae, but the sound and movement of water as it tumbles over rocks is a soothing and melodic amendment to prison life. This is an excellent project in design. Students can measure out slope, determine the height of the splash zone and the appropriate flow of gallons which will flow through the pump as well as the actual placement of rocks to create the desired effect. The waterfall represents the highest level of water gardening for both overall effect and level of difficulty. Test your waterfall and pools as you build. Making a water tight system requires extreme care! If you cannot obtain a liner large enough to cover all pools you may have to use some kind of roof flashing type cement to join liners. If you are making several pools you might want to explore the possibility of creating a filtering system using river pebbles or lava rock. Do not step on the liner as you work either, or you may damage it. Be sure to use a waterproof liner under the stones you are making the waterfall from. Wait till you have tested the system before you cement the stones in place.



**Fig. 8. Creating the waterfall.**

- a. Pump**
- b. Hoses to waterfall and filter buried underground**
- c. Leave a generous overlap if you must use more than one liner.**
- d. River pebbles or lava rocks act as a filter.**
- e. Water pumped to filter percolates up from beneath the pebbles.**
- f. Create a natural waterfall effect by studying nature.**
- g. Make sure that there is a liner under the waterfall so no water is lost.**

## PATHWAYS

Riddled with cliché, the building of paths is a wonderful metaphor for describing the inherent possibilities of constructing our own purposeful journey through life. Pathways should always lead somewhere, exposing elements of surprise, color, texture and form along the way. Pathways should vary in size according to their purpose and use. Materials, use and width will generally determine the make of your pathways. At Rikers, and in most teaching gardens, paths need to be wide enough to accommodate a large number of people, as well as equipment. There will be some areas, however, where the opportunity to create a more intimate walkway will arise, perhaps through a grove or large perennial bed.

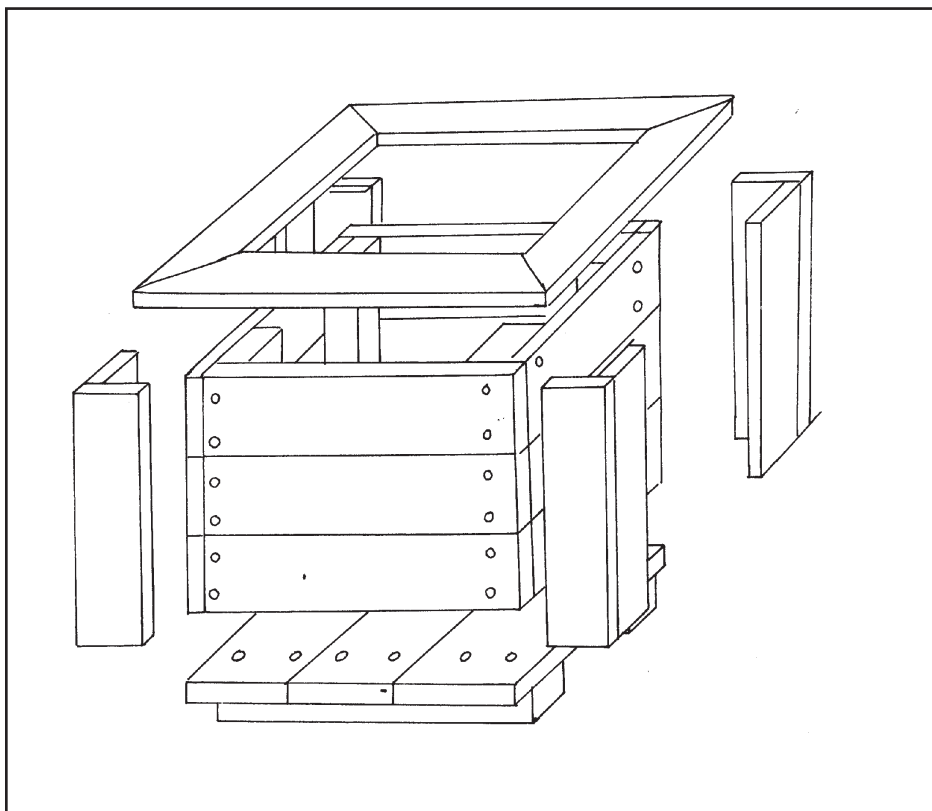
We generally use materials salvaged on the island or given to us by the City. Different materials such as pavers, cobblestones, bricks, slate and crushed stone are all integrated into our construction of pathways. And each material offers a different process of design and construction that students can learn from. For straight paths built of crushed stone we typically lay a 2 x 4 edging, while for bricks and cobblestones the edging is a straight line of different sized bricks with designed patterning in-between.

## CREATING THE PROGRAM

The possibilities for construction in prison are endless. At Rikers, using only a few rudimentary hand tools and a table saw, circular saw and router, inmates are now constructing planter boxes for elementary schools in New York City with a \$5,000 grant from the Board of Education. A form of restitution for inmates, it also allows the DOC to integrate its programs with the outside community.

This type of program can be easily replicated in other facilities in states around the country. The primary requirement is to develop contacts with the Board of Education and community gardening groups or public institutions in the particular city or town closest to your facility. Designs can be standardized from available books on garden structures, or designed by students based on their skills and own creative ideas. Often in each group, there is at least one inmate with experience in woodworking or carpentry. Rather than conduct formal classes we typically assign unskilled inmates as apprentices to learn the basic foundations of carpentry and design. This process is extremely effective and seems to reflect a more realistic method of learning.

Inmates typically appreciate the opportunity to construct products which are used by the community as opposed to the facility. Park benches, bird houses for elementary schools, window boxes for city libraries, even a pergola built in jail, and assembled at a library garden by former inmates is a chain of possibilities that your program can realize. There are often issues regarding the use of prison labor to supply public institutions with constructed goods and products. However, a job skills program generally by-passes inmate labor laws as the distinction is made between programs and prison work details.



**Fig. 9. Simple planter box.**

There are many excellent designs available for planter boxes, and you can come up with many more yourself. For *Zona Verde* we used a design created by NYC Project Greenthumb. We used a load of carriage bolts left behind by the farm crew to fasten all the pieces together. Using timbers salvaged from construction projects we were able to increase the number of containers we provided to the project.

Use untreated timber for boxes where vegetables will be planted. Make your boxes for perennials at least 16 inches deep. Boxes for trees should be 24 inches deep and 36 inches in depth and width if possible to enable trees to winter over without damage.



**Fig. 10.** Students building the planter boxes for P.S. 101 *Zona Verde* rooftop garden.

Building structures, even ones as simple as planter boxes, is an excellent way to encourage your students to carefully plan out their project before beginning. Planning can make the difference between an exciting experience and a frustrating one. It all depends on how you approach it. Before starting this project we: visited the site; prepared scale drawings of each and every different element; and even went so far as to create scale models. You'll be surprised at how much more simple it is to explain a project with sketches and models than it is with mere words.



**Fig. 11.** The finished rooftop garden.

If you decide to reach out to your community with this type of project you may want to consider leaving at least part of the construction to the elementary school students to complete. This takes a little bit more work but really enhances the sense of ownership among students. In this case the bottoms were left off the boxes. Back at our shop we predrilled the bottoms so students at P.S. 101 could easily hammer them on. Liners made from shower curtains were used to prevent rot. Many of the plants for the project came from Rikers Island nursery and Greenhouse.



### **Two of our favorite garden structure books**

**American Horticultural Society Arches & Pergolas**, by Richard Key  
2000, Droling Kindersley Publishing, Inc., 95 Madison Avenue, New York, NY 10016

**Garden Projects You Can Build**, by David & Jeanie Stiles  
1995, Chapters Publishing Ltd. 2031 Shelburne Road, Shelburne, Vermont 05482

## Chapter 14: The Greenhouse, Starting Plants Indoors

***“The greenhouse must function for your program’s basic needs. Is it mass production . . . or houseplant care, . . . or perhaps a multi-use system that gives students the best opportunities to learn about managing a greenhouse?”***

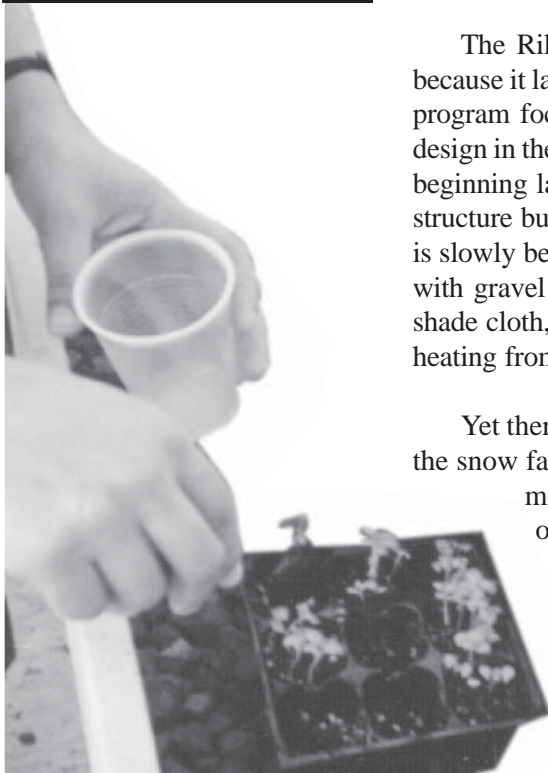
**O**f all the structures in your system, the greenhouse will be the most programmatic and in most instances a focal point of your entire project. The greenhouse offers innumerable opportunities to establish a self-supporting, and if in temperate regions, a four season program. Here is the nerve center of your operations, where students congregate, where seeds are germinated and seedlings grown, where plants are propagated, and where tropical houseplants are nurtured through the fall and winter.

Greenhouses seem to vary in every prison, and therefore their purpose and intended use will also differ. Some are strictly used for intense plant production, supplying the prison farm or other facilities with vegetable seedlings, or annuals that the facility will plant around its buildings. Others, including the state facility in Florida, have extremely sophisticated greenhouse systems that focus on the propagation and production of exotic tropicals such as orchids and bromeliads. Massachusetts has a four-season program that produces poinsettias in the winter and annuals all spring and summer.

The Rikers greenhouse is not used as much for intensive production, and because it lacks the appropriate cooling and heating system, we run a three season program focusing on plant propagation in the fall, houseplant care and interior design in the winter, and the production of perennial, herb and vegetable seedlings beginning late winter until spring. The greenhouse itself is a 30 foot by 20 foot structure built with a 3 foot brick foundation, aluminum beams and glass, which is slowly being replaced with plexiglass. There are three 26-foot benches bedded with gravel and a large steel potting and mixing table. There are top vents, no shade cloth, a rudimentary misting system, a few leaks from the roof, and steam heating from side vents that may or may not work through the winter.

Yet there are few sights more magical than working in the greenhouse while the snow falls in winter, surrounded by the rich foliage of tropical houseplants, mendequilla vines, the smell of jasmine and gardenias and the image of orchids. Just outside is a bird feeder in a small winter garden that attractsover-wintering birds to the greenhouse. Students can observe and identify birds while they work in the greenhouse.

And despite our rudimentary system, in Spring 2000, the greenhouse produced over 3,000 plants from seed for our vegetable and herb gardens as well as perennials for our bird and



butterfly gardens and for gardens in different jails around the island. We also donated a number of our germinated plants to community groups, elementary schools and libraries in New York City.

With a greenhouse, the programs take on a whole new learning dimension. Without one, the horticulture program should take the necessary steps in funding a used or prefab system, or having the inmates design and build one themselves.

## TYPES OF GREENHOUSES

The greenhouse is perhaps the ultimate expression of how humans attempt to manufacture and control their environment. One of the earliest known greenhouses was built around 30 A.D. for the Roman Emperor Tiberius who had a craving for out-of-season cucumbers. Called a specularium, it was crafted painstakingly out of translucent sheets of mica.

The next jump in technology occurred in 1599 with a system made with glass designed by French botanist Jules Charles. Charles hoped to grow tropical plants for medical use. The design caught on and for the next century improvements were made including heating systems and angled glass. The wealthy in France built more elaborate systems to satisfy their cravings for oranges while the Russian Czars tried to outcompete the French aristocracy with a complex featuring three 700 foot greenhouses fueled by wood burning furnaces with ceilings 40 feet high for fruit trees and tropical palms.

Greenhouse technology however, flowered in the Victorian Age in England in the mid-1800s as glass was manufactured at lower costs and in increasing quantity. London's Crystal Palace built in 1851 was a breakthrough in design with the use of glass and steel and became a overblown model for the soaring conservatory at Kew Gardens. The aristocracy replicated smaller versions for their estates, and tropical plant collecting exploded as the wealthy tried to outbid the other with extensive inventories of rare orchids, bromeliads, ferns and tropical spice and fruit trees.

By the end of the century, greenhouses became more common for food production, nursery propagation and seed production. Heating systems included south-facing fronts that better utilized the sun's energy. Cooling vents and convection systems were improved and simplified. And in 1991, perhaps the most elaborate and most technologically advanced greenhouse opened as the Biosphere near Tuscon, Arizona. By constructing a cluster of glass-enclosed ecosystems, the originators sought to create a sustainable and self-regulating world that could provide food and oxygen, undergo climatic change, recycle nutrients and support a small human population for an extended length of time.

**Fig. 1. The greenhouse at Rikers Island.**

**The traditional design of our greenhouse is extremely practical for raising seedlings and growing houseplants. Before buying a greenhouse carefully consider how it will be used in order to select the most suitable kind.**

**Greenhouses or poly houses can be extremely pretty as well as very practical and cost effective. The modern greenhouse is the culmination of many generations of gardening technology.**

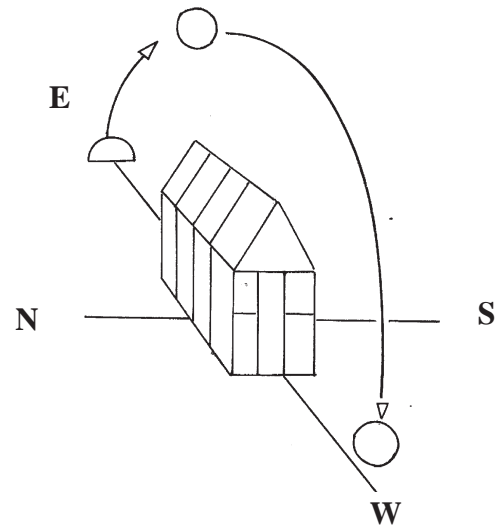
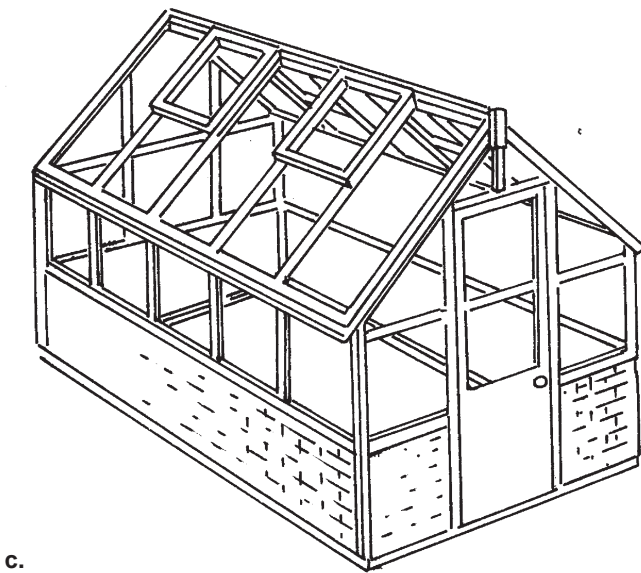
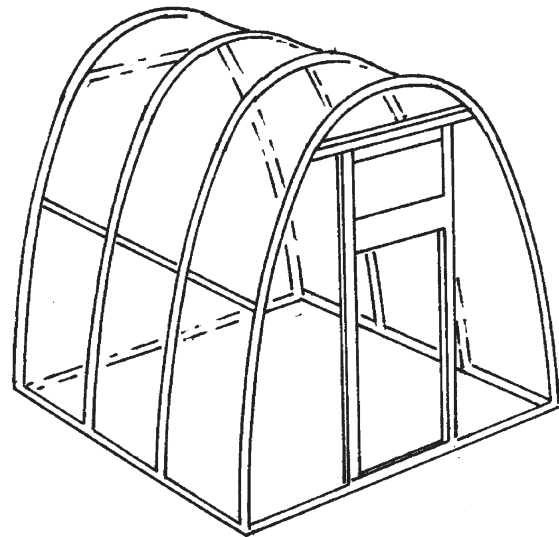
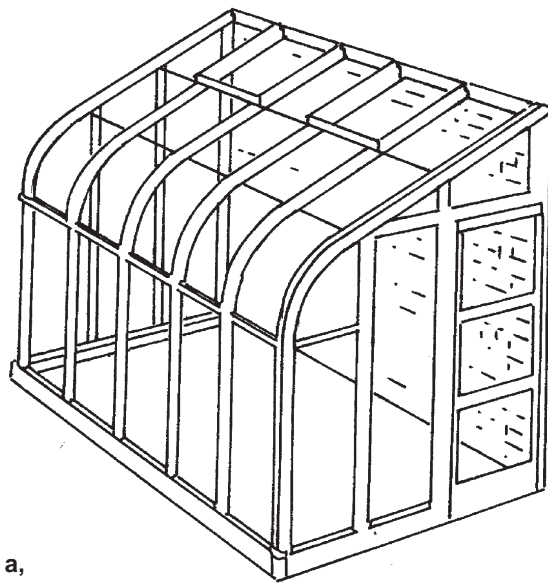




## THE GREENHOUSE PROGRAM THAT SUITS YOUR NEEDS

The greenhouse must function for your program's basic needs. Is it mass production of annual and perennial seedlings or houseplant care, or indoor vegetable production or perhaps a multi-use system that gives students the best opportunities to learn about managing a greenhouse? What are your goals and do they meet the expectations of both the jail and program?

The program at Rikers employs a number of horticultural based projects designed specifically to increase the student's knowledge and skills in running a greenhouse. As the program moves inside for the winter, a number of activities take place that emphasize plant care and maintenance, potting, mixing soil, seedling germination, and propagation.



**Fig 1. Types of greenhouses**  
a. Lean-to greenhouse  
b. Poly houses are easy to make  
c. Traditional greenhouse  
d. Orientation to the for optimum heating



## HOUSE PLANTS

In addition to other benefits, NASA studies indicate plants actually scrub indoor air of pollutants common to the office, as well as helping balance relative humidities.

Houseplants are used to soften and naturalize the inside of offices and homes as well as the interior areas of public spaces. They may be plants that are chosen for showy or unusual flowers, or strictly for their foliage. They may be the size of trees or shrubs or simply trailing vines. They may be plants that use little water and require much sunlight such as desert cacti, or need very little sunlight and constant moisture such as ferns. There is however one trait that most houseplants share in common: they are plants that keep their foliage all year round. Unlike deciduous plants, houseplants are generally from warm climates. These plants can adapt to building interiors where the temperature stays relatively constant.

While most of our students have little exposure to gardening or horticulture, many of them are familiar with the general care and maintenance of houseplants. But where do houseplants come from? And why are they generally suited for indoor settings? Understanding the specific niche houseplants occupy in their native environment, not only increases the students' knowledge of basic principles of ecology, but informs them of the plant's specific care requirements.

A majority of houseplants derive from the equatorial tropics where light, moisture, humidity and temperature are generally constant through the year. Because the temperature rarely drops below 55 degrees few plants from this region enter periods of dormancy, providing year-round foliage for indoor use. Large broad leafed plants such as spathiphyllum, philodendron, pothos and dieffenbachia, the prayer plant, as well as tropical ferns are genera and species that are more tolerant of low light levels and are therefore good for indoor areas that receive little or no natural light. These plants occur naturally in the low understory of tropical rainforests where light is heavily filtered through the upper layers of the forest canopy.

Bromeliads and orchids occupy a different ecological niche in the forest. These colorful flowering plants cling to the forks and branches of tall canopy trees where they collect nutrient-rich rainwater dripping off the bark and leaves of their host trees. Because their roots are used mainly for support and not to absorb moisture and nutrients, they are commonly referred to as air plants or epiphytes. The thousands of species found in these families are specifically adapted to varying levels of light and moisture found in their environment. More sun tolerant bromeliads for example are found higher up in the canopy and not only depend on more light, but are tolerant to more dramatic changes in temperature and moisture levels – a reflection of the greater stress found in that environment.

### Introduction to Greenhouse management

- \* History of Greenhouse structure and design
- \* Fall maintenance : The importance of Cleanliness: scrubbing the rocks and floor with bleach to sterilize the system against fungi and pathogens. Removal of any weeds or germinated seeds beneath the beds.
- \* Temperature and light : maintaining and monitoring temperature and light fluctuations in the greenhouse for a diverse mix of plant types.
- \* Watering: Automatic versus hand. Arranging your benches to ensure that tropicals as well as plants that require drier conditions receive the correct amount of watering.
- \* Heating and cooling systems: Understanding how these systems work in the greenhouse and ways to maintain them for winter and summer use, including the use of shading.
- \* Organizing plants in the greenhouse: Tropical houseplants, cacti, dwarf fruit trees, and germinating seedlings will have different light and watering requirements.
- \* Soil mix: for bedding plants and houseplants
- \* Planting and propagation
- \* Houseplant care and maintenance

The tropics are not only comprised of thick forests. There is an entire range of climates and biomes which range from mountain evergreen forests to scrub deserts, each contributing their own variety of species used as potted houseplants. Croton, a fast growing foliage plant with thick red leaves and deep green venation, is a pioneer colonizing wasteland sites throughout the tropics. Vines such as mandevilla and stephanotis are light seekers with profuse blooms in dry hot climates. And those large potted trees one sees in offices and hotel lobbies usually belong to the ficus family, a varied group that form twisting upright canopies in the rainforest, colonizing small gaps in the jungle where light and nutrients are available.

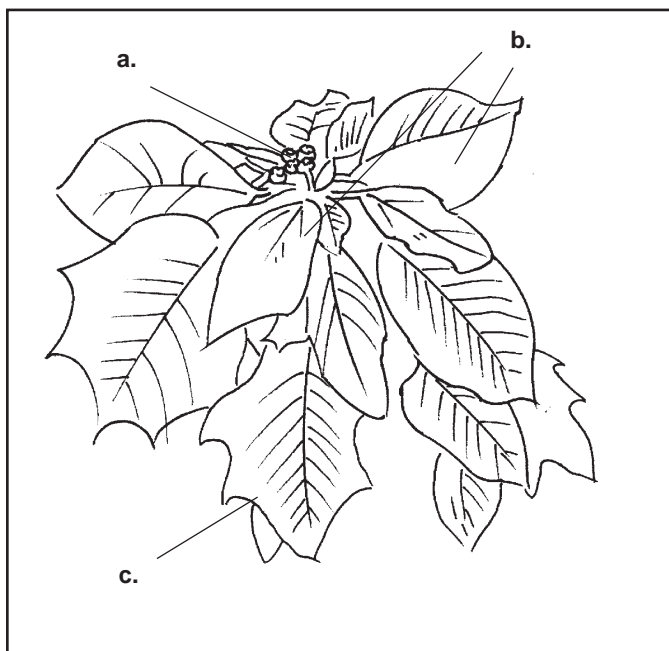
### **Poinsettia (*Euphorbia pulcherrima*)**

The poinsettia has been an important part of Christmas in America since 1825 when Joel Roberts Poinsett collected sixteen plants near Taxco, Mexico and brought them back to his home in South Carolina. In its natural habitat, which stretches from Central America into tropical Mexico, it grows into a large shrub, often over ten feet high and produces its bright red blooms throughout the winter. The showy red “petals” are actually bracts, or modified leaves, that serve to attract the pollinating bees and flies to the tiny yellow flowers in the center.

After Christmas – Cut back to 6” or 8” after it has finished flowering. If necessary repot in a good mixture such as equal parts soil, peat moss, and perlite. Feed regularly and pinch back the new growth six weeks to keep the growth under control.

Reflowering – Poinsettias are photosensitive; their flowering cycle is controlled by the amount of light and dark they receive. To trigger bud formation, the plant must have at least 14 hours of total darkness each night for six weeks. Black plastic garbage bags are an effective means of blocking out light. During the day, the plant should receive regular care. After the six weeks, the plant can once again receive artificial light and should flower in one month.

Poinsettias are generally easy to propagate and grow and can be an important greenhouse crop for a jail or prison program. The Massachusetts program has devoted an entire section of their greenhouse to providing different institutions with plants for the Christmas holidays.



Thick-leaved plants are often less reliant on constant moisture and require direct sun to bright diffused light since they have special adaptations to dry hot climates. Plants with broad thin leaves are generally shade-tolerant and require more moisture. The familiar whorled leaves of the bromeliad forms a cup which allows the plant to capture and contain water streaming off the trees and leaves. Certain orchids and tilandsia, a type of bromeliad, are misted while cacti are only watered monthly. Plant lists with specific care requirements are an important resource for the greenhouse. Students should learn specific names and family groupings, their place in the environment and their overall maintenance.

**Fig. 3 Poinsettia *Euphorbia pulcherrima***

- a. Flowers**
- b. Bracts**
- c. Leaves**

## CARE AND MAINTENANCE WORKSHOP

### Finding the name:

Assuming that your greenhouse has a wide selection of houseplants, the first step is ensuring that students are familiar with their names and genera. Identification books are a necessary requirement for this process. Divide the class into groups and assign them a several plants to identify and name. A sheet with the following questions should be given to each group:

- \* Plant Name
- \* Origin
- \* Light and water requirements
- \* Description of leaves and flowers
- \* General care
- \* Method of propagation

### Exercise 1 House plant identification

#### Materials:

- \* Labels or cards and pencils
- \* A good house plant book
- \* Watering can
- \* Commercial fertilizer or compost (be careful not to introduce any pathogens into the greenhouse)
- \* Binder with clear plastic pages
- \* Camera

#### Procedure 1:

- \* Group members choose a plant to adopt
- \* Using house plant book, search for each plant
- \* Create a card for each plant identified, including the name, and watering, light, and temperature and fertilizing needs of the plant
- \* Observe the appearance of the plant: Does it need water? When was the last time it was fertilized?
- \* Water and fertilize if necessary; adjust position to suite plant's sunlight needs.

#### Procedure 2:

- \* If it is possible to obtain permission to bring a camera to the classroom or greenhouse photograph each plant; alternatively, search for photograph in magazines, catalogs and books of your plants
- \* Create a plant care binder, including all the house plants in your greenhouse or classroom.

**Fig. 4 Sample pages from the home made houseplant care manual made by the students and teachers of the Greenhouse program and including students who went from the Greenhouse program to gardening internships at The Horticultural Society of New York.**



**Anthurium**

**Partial shade  
Light Water**



**Bird of Paradise**

**Full sun  
Average moisture  
Propagation by division  
Blooms when potbound**



**Bromeliads**

**Water in the waterproof cups formed by the juncture of the stem and leaves, constant humidity, spray often, water less after bloom  
Propagate from stem cutting  
Very bright place  
Feed every 2 weeks**



**Cactus**

**Spring to fall - very bright to sunny  
October to spring - bright and cool  
Outdoors after May  
May to September - water when dry  
October to May - keep dry  
Phosphorus fertilizer every 14 days after new growth**





**Croton**

Spring and summer keep damp  
 September to March - water a little less  
 Mist often  
 Bright but not sunny warm (61) all year round  
 Propagate January to March - tip and stem cutting



**Gernaium Pelargonium grandiflorum hybrids**

Summer - warm, Winter - cold  
 Propagate from tip cutting in August in peat and sand



**Aloe**

Spring to Fall - moderately damp  
 Bright but not full sun location  
 Repot each Spring in soil less mix and sand  
 Never let get soggy!  
 Propagate by separating sprouts, allowing to dry and sticking in soil.



**Radiator plant Peperomia**

Summer - bright to semishade  
 tolerates dry air  
 Avoid cold feet in winter  
 Slightly damp  
 Fertilize once a month.  
 Propagate by tip and leaf cuttings.

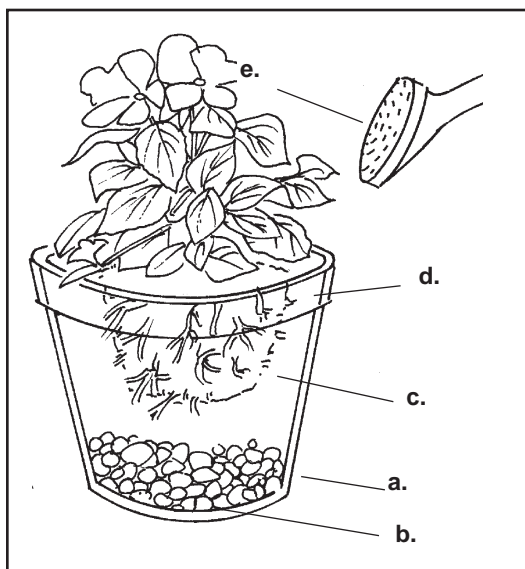
## GROOMING:

Houseplants live in a self-contained environment and are completely dependent on outside care for their health and vigor. Students should be able to maintain houseplants through simple grooming methods. Check the condition of the leaves. Are they healthy, green and lustrous? Are there any signs of insect damage, mealybugs or spidermites? Prune back dried flowers, dead twigs and branches, and remove yellow or dried leaves. Are there brown spots resulting from sunburn, or curling brown leaves that may indicate nutrient deficiencies.

Check the plants for watering. Are they properly watered? Too much moisture will result in waterlogged conditions for root rot. Many houseplants require the soil to dry out before watering. But because the wilting level is extremely high in pot-bound plants a hot, dry spell can be especially damaging. Misting helps raise the general humidity level that is beneficial to tropicals but harmful to desert plants such as cacti and kalanchoe.

Root bound pots will slow the plant's growth and inhibit its ability to flower. Check the pot. Does it feel light? Sift through the soil. As root mass displaces soil it may be time to repot in a larger container with fresh potting mix.

A simple but diligent routine will enable students to manage house plants in the greenhouse on their own. This process is instrumental in helping students take the initiative to troubleshoot problems, develop solutions and establish a valuable work ethic that should last long after their release from prison.



**Fig. 5. Repotting technique**

**a.** Plants that have filled their containers should be replanted in a container a size or 2 larger. Always use a clean pot.

**b.** Fill the bottom of the container with pot shards or gravel for good drainage. The extra weight will help prevent plastic pots from being knocked over.

**c.** Make sure the plant's root ball is moist by watering. Gently tease out the root ball, fill the bottom of the pot with soil mix.

**d..** Place the plant correctly into the pot at the appropriate height. The soil level should be to within 1/2" of the rim. Fill the area surrounding the root ball with soil mix.

**e.** Firm down the soil and water.

### 5 Great Toxin Removers

In his book *How to Grow Fresh Air*, Dr. B.C. Wolverton tested 50 houseplants for their ability to remove toxins from indoor air.

Areca palm *Chrysalidocarpus lutescens*: Removes chemicals at a high rate and easy to care.

Bamboo palm *Chamaedorea seifrizii*: Best for adding humidity to dry air.

Rubber plant *Ficus elastica*: Tolerates low light and absorbs formaldehyde.

Boston fern *Nephrolepis exaltata*: Best at removing pollutants.

Peace lily *Spathiphyllum spp.*: Has a high transpiration rate and blooms reliably indoors.

## INTERIOR DESIGN:

In large urban areas such as New York City, there is ample opportunity to find employment in the indoor plant business working with companies involved with installing and maintaining office houseplants. Interior design is quickly growing as companies expect more than just maintenance for their public space. Placement, lighting, pots, and plant combinations are now all part of arranged interior settings for lobbies, offices, waiting rooms and other public spaces. A few important tips in interior plantscape along with practice can increase the student's opportunities for work in this growing field. Maintain a constant theme: moist tropicals and dry succulents should not be mixed together. Add river stones to dry loving plants and moss to dark or moisture loving foliage plants or orchids and bromeliads.

The warden will likely appreciate the program's efforts to design and maintain spaces inside the jail. Visit rooms, offices and other interior spaces used by the public and staff are all possible projects that contribute to practical experience for students and make your program more valuable to the facility.

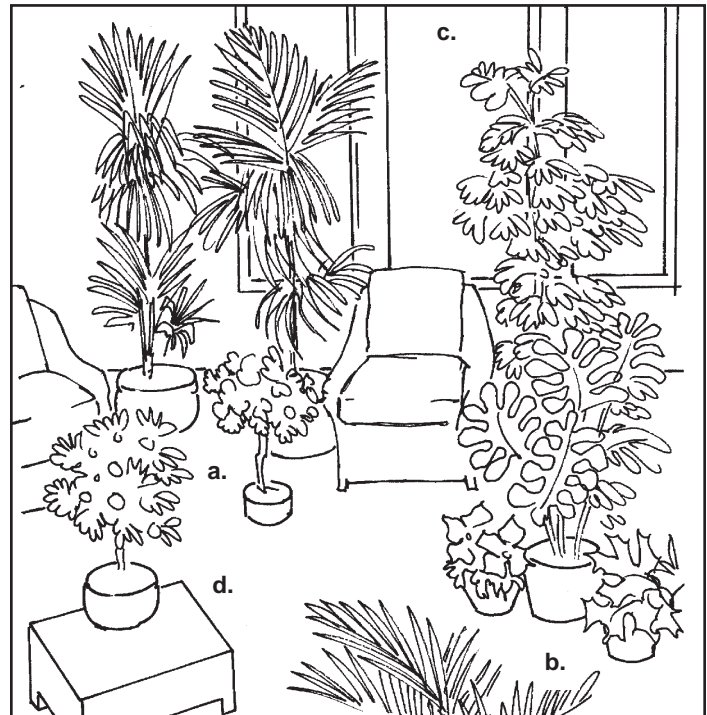
Avoid tall plants in low ceiling rooms. No floor space? Plant shelves are effective with small or trailing plants. By a combination of pots plants, lighting and design, the outdoors may be brought inside.

### Materials for Use

The greenhouse can serve as a nursery for unwanted or damaged houseplants. Plant stores or wholesale plant nurseries are excellent sources for materials that cannot be sold to the public but can be donated to your project. Pruning, repotting, the appropriate humidity and watering and a good top dressing of compost is generally what's needed to restore houseplants to good health. If the greenhouse should become overcrowded, plants will always find a welcome home inside the jail, or can be distributed to public hospitals, nursing homes, day-care centers or other facilities that need plants to enliven their interior space.

**Fig. 6. Plants for the office.** There are some officers that we work with who enjoy having plants in their offices. It's a challenge to convert these drab spaces but it is also an opportunity to practice the skills of interior plant design.

- a. Use containers to soften sharp angles in the room.
- b. Occasionally bunch plants accordingly for dramatic effects using texture and color.
- c. Use vertical heights with large plants in the back, medium and smaller plants in the foreground. Vines can trail overhead or wrap up poles.
- d. Pots are an integral part of design. Avoid plastic when possible.

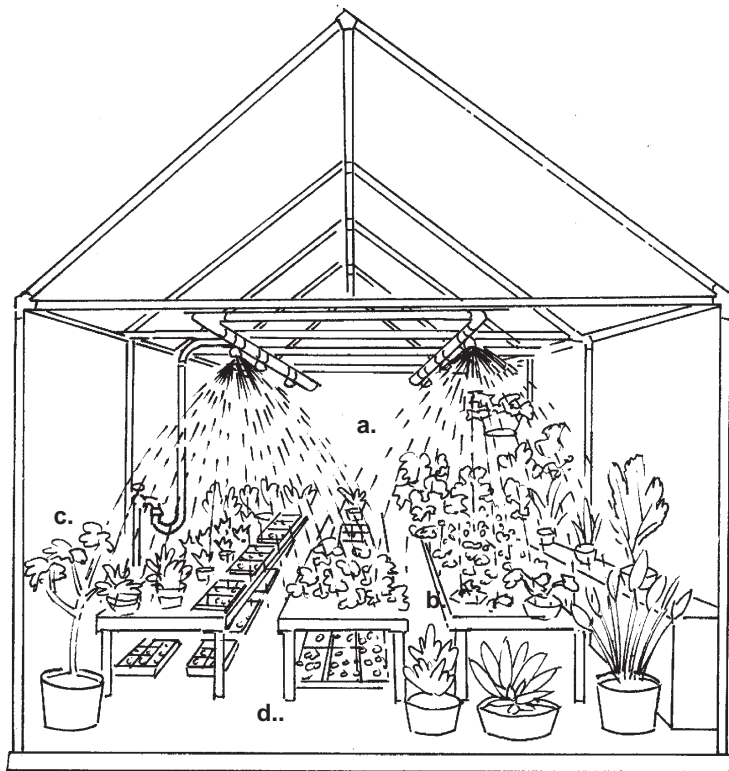




Cuttings are another excellent source for producing your own stock of houseplants. Pothos, coleus, purple passion, spider plants, geraniums are just a few of the household plants which propagate easily and grow quickly from cuttings.

Pots are generally easy to come by once you're on the lookout for them. Yard sales, nurseries, and plant stores are just a few possible sources for planting or repotting pots available at low or no cost. Damaged clay pots should be saved and used as drainage shards while discarded plastic pots are useful for transplants or for newly rooted cuttings. Decorative baskets, pieces of driftwood, old watering cans, even a discarded sneaker make interesting containers for your houseplant pots or as mounting boards for orchids and bromeliads.

Students should leave your program with the idea that houseplants are more than just reflections of the natural world; they are extensions of the student's creative ability to order their world in a healthy and aesthetic manner.



**Fig. 7 Arranging your indoor garden**

Though a greenhouse is usually more practically used than a conservatory, some space can still be devoted to ornamentals. The variety of caring for diverse indoor plant population is challenging. During certain times it may become necessary to remove plants either to protect them from heat or cold.

a. Because it may not be possible to water during the weekends, a simple misting system on a timer is absolutely essential to the survival of seedlings during the warm months. Ours is constructed of PVC piping and misting heads. You can easily lose an entire crop of seedlings in a single hot weekend. In an uncooled greenhouse the temperatures may easily reach 120 degrees.

b. Group like seedlings together on the benches for constant watering once they have been transplanted. Taller ornamental plants can be grouped in interesting combinations on the benches and along the sides of the greenhouse. Observe the passage of shadows during the day to determine the best place for each plant based on light needs.

c. Place taller plants and trees on the floor.

d. Protect germinating seeds for direct sunlight by placing them underneath benches. This also increases the greenhouse's capacity for production.



## GROWING PLANTS FROM SEED

Growing plants from seed is generally the most effective and productive use of the prison greenhouse. One 20' x 3' bench can easily support 1,000 plants. At 6-week rotations for a total of 6 months the number reaches 4,000 plants. The Rikers greenhouse, with 3 available benches, is capable of producing 12,000 plants in a half-year period. The potential to provide ample herb, vegetable, annual and perennial seedlings to the Island's jails, or to different institutions in New York City is enormous. While our greenhouse rarely strives to reach that potential, other jail programs rely heavily on their ability to produce bedding plants for both commercial and/or in-house use.

The seed has three basic parts which ensures the plant's survival:

- \* The coat — keeps moisture out to prevent premature germination
- \* The cotyledon —acts as the new plant's food storage
- \* The epicotyl — the emerging first leaves of the plant
- \* The hypocotyl — the emerging roots

### Exercise 2 Seed Dissection

#### Materials:

- \* Several lima beans for each student
- \* Notebooks and pencils
- \* bowl of water
- \* Magnifying glasses
- \* Biology book

#### Procedure:

- \* Soak half the beans overnight to loosen the seed coat.
- \* Compare the dry seed coat to the soaked seed coat.
- \* Remove the seed coat carefully from the soaked bean.
- \* Observe and record the appearance of the seed coat under a magnifying glass.
- \* Split the seed in half, use the magnifier to record your details.
- \* Look for these parts: embryo, seed coat, cotyledon.
- \* Research the purpose of each of the parts of the seed using the biology book.
- \* In your notebook make a careful drawing of the seeds parts and label them along with your research into the purpose of the parts.

**Fig.8. Growing plants from seed.**

We sowed many vegetable seeds in our cool greenhouse. This is vital in climates with cool summers and for vegetables that mature slowly. the health of seedlings is more easily monitored and controlled indoors especially if you can maintain control of the temperature. Some perennials may need warmer temperatures to germinate. Once seeds have germinated, keep them at lower temperatures to avoid drying out.

Seeds like to germinate out of the direct light, keep seed trays under benches until they germinate. Later on transfer them to individual pots and place them on top of the benches.

Seedlings need to be moist not soggy.



Seeds are generally easy to germinate and only require moist soil, a steady warm temperature (between 55 and 75 degrees) and adequate light. For depth of planting, the rule of thumb is approximately twice the thickness of each seed.

Space small seeds 1/8" apart, medium seeds 1/2" apart, and large seeds 1" apart. A humid environment encourages germination: when possible cover the container or planting trays with a clear plastic "tent." This allows light to come in and maintains moisture. Do not seal completely.

When store bought seeds have trouble germinating, it is usually because the student planted it too deeply or did not moisten the soil often enough. Students also have a tendency to water directly on top of the planted seed, which presses it into the planting mix or washes it out altogether. We recommend a heavy misting either by hand or through an automatic system.

The soil mix is especially important. Because seeds have their own store of nutrients, the soil should be light and permeable, allowing the roots to quickly develop and for moisture to penetrate evenly. We generally use peat moss, vermiculite and perlite at a 2:1:1 ratio. The vermiculite, a mica-based mineral helps retain moisture and capture nutrients which the germinated plant will use for its early growth. Perlite is volcanic rock heated up to a consistency like popcorn and aids with drainage and air pores. Peat moss, mined from bogs, absorbs moisture and helps anchor the newly formed roots.

Have the students label each tray with an indelible marker or some other material that will weather continuous misting. While this may seem like an obvious statement, seedling trays wind up being shuffled around during transplanting, labels wash off or get lost and within no time you end up with hundreds of trays with unknown varieties of germinated seedlings.



**Fig. 9 Mixing indoor soils.**

**Making your own indoor soil is much more economical and gives you greater control over the germination process. We use a tremendous amount of indoor soil during the spring. By the end of the germination season, the formula 2 parts peat moss, 1 part perlite, and 1 part vermiculite has been assimilated by each student.**

**Once seedlings establish their second set of leaves it will become necessary to transplant them into a more nutrient rich soil. Mixing in an equal part of commercial compost or fertilizer with soil-less seed-starting mixture provides the basis of potting soil. Although we make our own compost on the Island, it is too active to use in the greenhouse especially if it has been laying around the garden for a while.**

**Soil is a potential medium for all sorts of fungi and viruses so be very careful about what kind of soil is brought into the greenhouse.**

### **Exercise 3**

#### **Mixing 2 different types of indoor soil**

##### **Materials:**

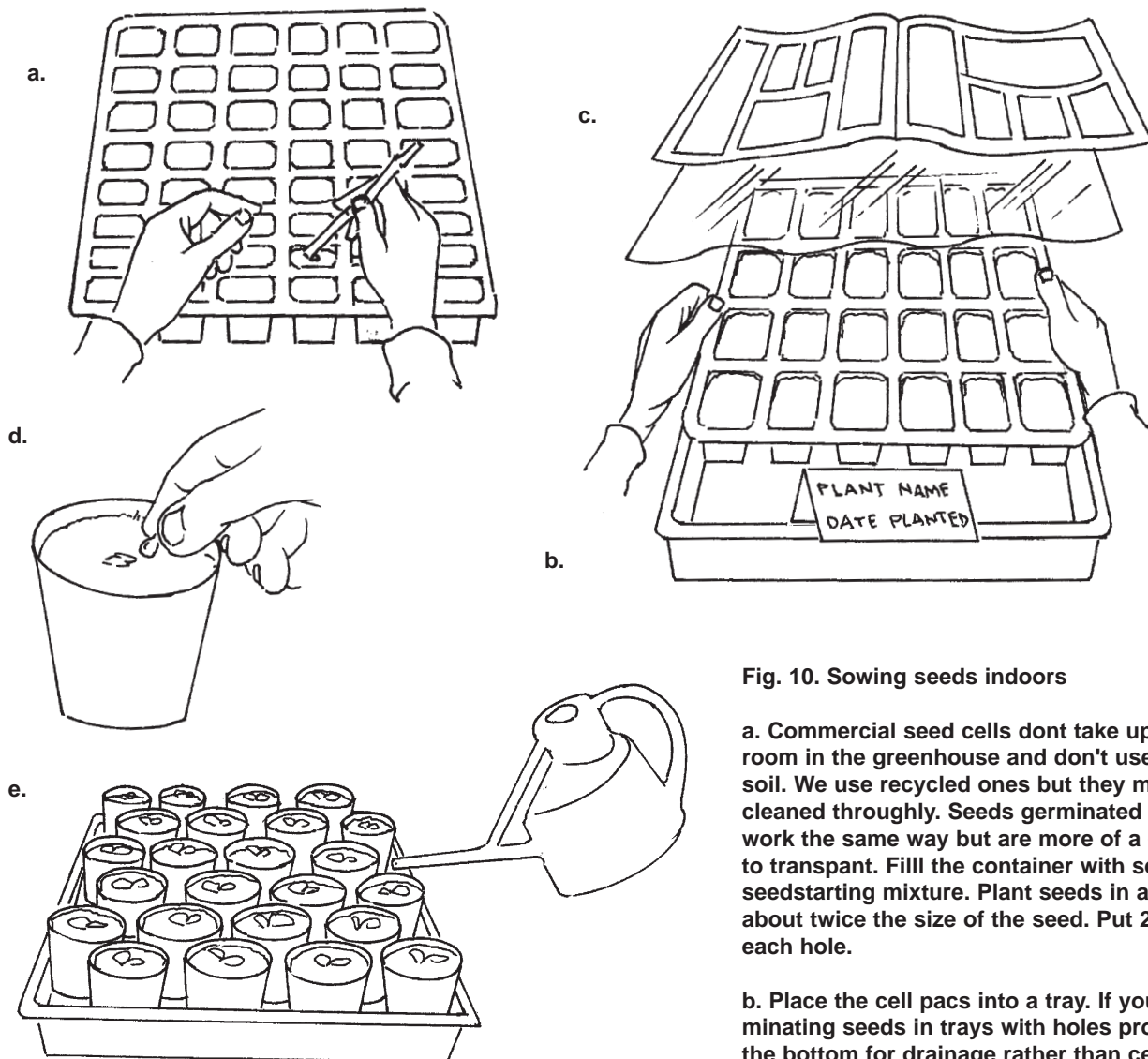
- \* Large mixing bowl
- \* Measuring container such as 6" pot with holes blocked
- \* Watering can
- \* 1 capful of bleach
- \* Perlite
- \* Vermiculite
- \* Peat moss
- \* Commercial compost or manure
- \* Poster-sized paper and glue
- \* A good gardening book

##### **Procedure 1, "soilless" seed starting mix:**

- \* Research the properties of each of the constituent parts of "soilless" seed starting mix: perlite, vermiculite, and peat moss.
- \* Mix 1 capful of bleach with 1 gallon of water and sanitize the containers and all implements to ensure that there are no pathogens remaining from last season's use.
- \* Measure and mix dry 2 parts peat moss, 1 part vermiculite, and 1 part perlite.
- \* Reserve half the mix for use in procedure 2.
- \* Add water until the mixture assumes the consistency of a wrung-out sponge.
- \* Create a poster by outlining a container and gluing 1 part perlite, 1 part vermiculite and 2 parts peat moss into boxes drawn on the poster. Label and define the qualities, quantities and uses of each constituent part
- \* Title the poster: "Soil-less" seed starting mix and state its use.

##### **Procedure 2, Potting soil:**

- \* Research each importance of compost or manure in the potting soil mixture.
- \* Sterilize the implements and containers.
- \* Starting with the "soilless" seed starting mix, mix in an equal part of commercial compost or dry manure.
- \* Create a poster similar to the one in procedure 1 with the addition of the compost.
- \* Title the poster: "Potting soil" and state its use.



**Fig. 10. Sowing seeds indoors**

a. Commercial seed cells don't take up much room in the greenhouse and don't use much soil. We use recycled ones but they must be cleaned thoroughly. Seeds germinated in trays work the same way but are more of a challenge to transplant. Fill the container with seedless-seedstarting mixture. Plant seeds in a hole about twice the size of the seed. Put 2 seeds in each hole.

b. Place the cell packs into a tray. If you are germinating seeds in trays with holes provided in the bottom for drainage rather than cell packs you can place them in slightly larger trays. Mist the seeds and put water in the bottom of the trays. Seeds absorb moisture very well by induction.

c. Cover the trays or cell packs with a sheet of plastic to retain humidity and a sheet of newspaper to lessen the effect of direct sunlight. Place them under the greenhouse benches.

d. Large seeds like beans can be germinated directly in individual containers of potting soil.

e. Place the individual containers into trays and water by induction as well as mist.

f. Student at the greenhouse germinating seeds. He's wearing gloves to protect seeds from pathogens.





## **Exercise 4**

### **Germinating seeds in flats cells or individual cups**

#### **Materials:**

- \* "Soilless" seed-starting mix from exercise 3
- \* Individual cell commercial seed-starting flats
- \* Small individual post
- \* Trays of various kinds
- \* Seeds
- \* Misting bottle
- \* Paper and indelible markers
- \* Plastic sheets
- \* Newspaper
- \* Gardening book that contains information about seed starting

#### **Procedure 1, Individual cell commercial seed starting flats (for small seeds):**

- \* If reusing last years flats, sterilize as in exercise 3.
- \* Fill each cell with "soilless" seed-starting mix.
- \* Plant seeds to the depth indicated on the seed packet or in the case of seeds collected from your own gardens, research the correct depth in a gardening book.
- \* Mist the flats of seeds thoroughly, cover with plastic to keep moisture in and cover with newspaper to keep light out.
- \* Carefully label the flats with the type of seed being germinated and the date.
- \* Monitor your seeds, water from below by putting a little water in the bottom of the tray beneath the individual cells – newly germinating seeds must be kept moist not soaked!

#### **Procedure 2, Individual pots (for large seeds):**

- \* Sterilize your implements and containers.
- \* Put a small piece of newspaper at the bottom of each pot to keep moisture in.

- \* Fill the containers to within about 1/2" from the top with potting soil and place two seeds in each to the depth indicated on seed packet or in a gardening book.
- \* Place the pots into a tray and put a little water in the bottom of each tray.
- \* Mark each tray with the kind of seed planted and the date planted.
- \* Cover with plastic and newspaper and place under a bench until first leaves appear.
- \* Keep seeds moist; water from below by placing a little water in the tray that carries the pots.

#### **Procedure 3, trays of various kinds:**

- \* Trays can be of 2 kinds — with holes to take in water from below or without.
- \* Sterilize the trays if they were used last year,
- \* Put about an inch of "soilless" seed starting mix in each tray.
- \* Space the seeds about 1" apart and cover lightly with 1/4 to 1/2" or seed starting mix.
- \* Moisten them by misting.
- \* cover with plastic and newspaper and place under benches or in the case of a cool greenhouse, in a warm place in the classroom.
- \* If you are using trays with holes you can place them into larger trays and put a little water in the bottom of the larger trays.
- \* If you are using trays without holes. you will have to monitor the watering more closely.

#### **Watering:**

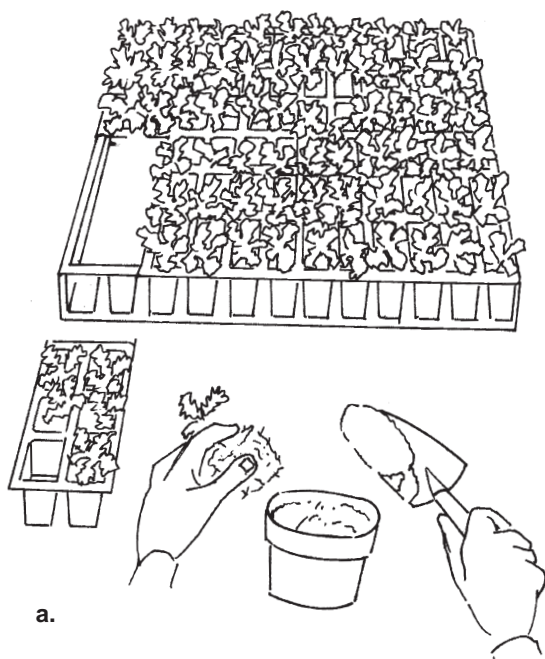
Having the option of watering trays, cells or pots from below is useful when you cannot be in the greenhouse during the weekends, especially when the greenhouse starts to heat up. You will probably find that some kind of misting system that uses sprinkler heads or drip hoses will be the only way to keep your seedlings alive during the weekends once your greenhouse starts to heat up.

## SEED COLLECTION

If the plant is native to your gardens, you may have to simulate cool spring conditions for the seed to germinate. Store seeds for about 40 days in a refrigerator at about 40 degrees to break the dormant period. The seeds can be mixed with a little slightly damp perlite in an open container and stirred every few days in the fridge. Then plant in a regular manner.

Once the seed has germinated, and the first two sets of leaves have emerged, the plants can use a weekly application of fertilizer. We recommend an organic preparation of diluted liquid fish emulsion or other similar compounds with a 10-10-10 solution, rather than the store bought "Miracle Grow" which is made from chemical mixes. The strength should be increased once the plants get larger.

Transplanting begins shortly after (when the plants are 4-5 inches tall) into small pots that will keep the roots contained. Use a potting mix with compost. Transplanting once or twice before planting; helps the seedling develop a strong root system, and ensures its survival during dry weekends or sudden cold snaps in the greenhouse. (Unlike commercial businesses, jail greenhouses are often only accessible during workdays. Occasionally at Rikers, electricity or the misting and heating system cuts off in the winter, jeopardizing the entire greenhouse



**Fig 11. Transplanting seedlings.**

**a. Carefully remove seedlings from their containers once they have produced their second set of leaves by first loosening the soil around the outside of the container then lifting the plant out carefully. Take as much of the original soil as possible. Plant into clean 3" containers filled with potting soil.**

**b. Students at the greenhouse transplanting seedlings into plastic cups.**

**c. Once seedlings are established you can water with an ordinary watering can.**



**b.**



**c.**

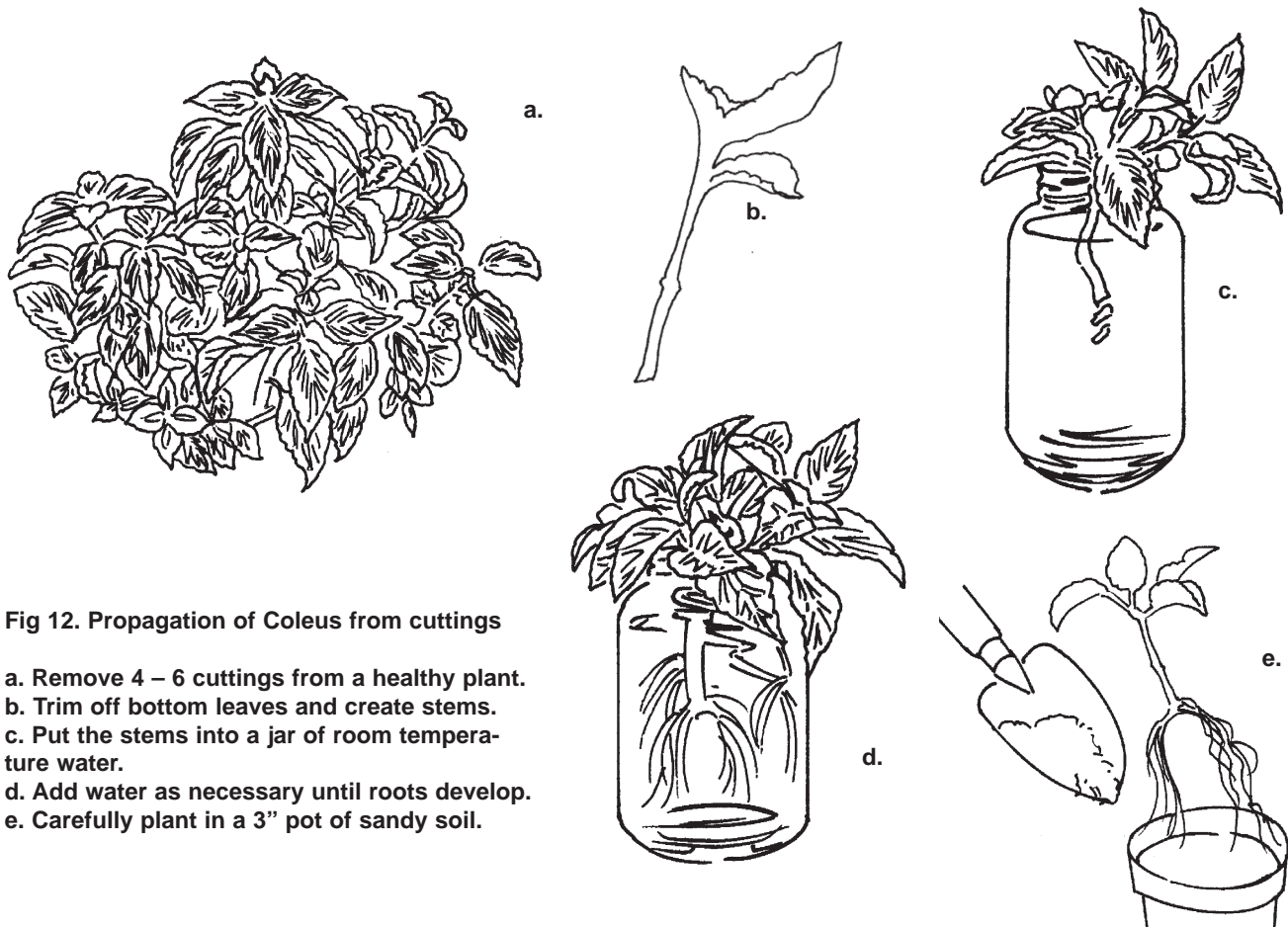
## PROPAGATION FROM CUTTINGS

A cost-effective way to increase production in the greenhouse is to propagate your plants from cuttings. For houseplants, bedding annuals and other softwoods, stem cuttings are a quick and effective way to establish new plants.

- \* Take the cutting from a healthy plant in early spring, choosing new, short-noded side shoots.
- \* Remove each cutting just above a node.
- \* Trim the cutting of all leaves just below the node.
- \* Insert the stems in a jar of water and wait for roots to form before potting.

Cuttings can also be established in a well-drained soil-less mix of coarse sand and perlite or bark. Dip the ends of each cutting in a rooting hormone powder and plant with leaves just above the soil mix. Root hormones, by delivering auxins (root hormones) to the base of the cutting, accelerate the process of root development and help prevent stem rotting. Place the mix under plastic for a constant range of humidity and temperature.

The greenhouse offers countless opportunities to teach students about plants and plant care while producing plant materials for the facility and its neighboring communities. Citrus trees can co-habitat with tropical vines, orchids, flowering geraniums, winter mesclun, and propagating bedding plants. In the tradition of the earliest glass structures, your greenhouse both incorporates and defies nature, creating a plant world defined by your needs and your own imagination.



**Fig 12. Propagation of Coleus from cuttings**

- Remove 4 – 6 cuttings from a healthy plant.
- Trim off bottom leaves and create stems.
- Put the stems into a jar of room temperature water.
- Add water as necessary until roots develop.
- Carefully plant in a 3" pot of sandy soil.



## Profile of several prison horticulture programs that utilize greenhouses

Installing a greenhouse could seem like an expensive component to your program, requiring detailed gardening knowledge, difficult to maintain and use properly. Many prison horticulture programs throughout the country have not found this to be true. For them the greenhouse is a perfect all-weather, three or four season gardening space. It has been cost effective and a good investment. Plants propagated there can be planted out in season and the lessons learned there can be taken away by the students, giving them a specialized and practical job skill. The ability to garden throughout the year more than compensates for the effort of either building, purchasing or seeking the donation of greenhouse.



### Mississippi State Penitentiary at Parchman Profile

Besides supporting the vegetable gardens in the greenhouse, students grow all of the flowers for the institutional grounds. There are several different varieties and all are started from seed and transplanted to flowerbeds. The greenhouse utilizes a drip irrigation system that allows for watering during the weekend. Because of the 24-hour nature of greenhouse operations, some kind of timed misting or drip watering system is an absolute necessity. According to Drew Dickerson, the horticulture instructor at the Mississippi State Penitentiary at Parchman, the greenhouse skills

program along with the rest of the gardening program benefits inmates serving long-term sentences in an entirely different but no less important way than shorter-term participants. While they may in fact never use the skills they acquire in the program in the workplace, the therapeutic advantages gained can help them battle the prisonization process. Although, because of the vocational context, those nearing parole are given preference for admission to the program.

The curriculum framework for horticulture unit used by the Mississippi State Penitentiary at Parchman comes from the Research and Curriculum Unit of the Mississippi State University. The coursework that provides the theoretical background and provides the student that successfully completes the regimen with college credits takes up about 20% of the total time spent learning and using gardening skills. The classroom component of the program takes place mostly during winter, a time when the greenhouse is especially important to an all-season learning schedule. The goal of the greenhouse and nursery production course is to develop skills and expertise in the selection of equipment and management of a greenhouse facility. Emphasis is placed on different media, supplies, and chemi-





cals used in greenhouses and on the scheduling and production of greenhouse crops. The competencies and suggested objectives include the ability to identify different types and advantages of greenhouses and nursery structures. Along with this is an understanding of the environmental factors that affect greenhouse production. Acclimation of plant materials is discussed and students are expected to identify harmful and useful gases found in greenhouses and describe their control. Students also develop and implement a plan and schedule for watering a given crop.

Understanding of the principles of plant propagation starts with knowledge of organic components used in soil-less media. From there, students move on to the advantages and disadvantages of the different methods for starting plants in a greenhouse, including seeds, plugs, liners, and rooted cuttings and the identification of appropriate sources for each. Finally they repotted both in the greenhouse and in the nursery and develop of a commercial marketing plan for greenhouse and nursery crops.

While it will probably not be possible for most county jails to go to such great depths in the study of greenhouse operations any successful use of the greenhouse must include the same topics used by Mississippi State Penitentiary at Parchman, even in a casual way.

### **Erie County Correctional Facility**

Seven years ago, Alden School District wrote a vocational educational grant proposal for the Carl Perkins Grant to purchase a greenhouse. The Alden School District provided the curriculum and John Fischer, an instructor who was already at the facility, took over implementation of the program. The Erie County Facility houses inmates with maximum sentences of two years. Anyone can volunteer for the program and those participants who are under twenty-one must first complete their GED. As long as there are no security issues, they are allowed to work outside of jail. They do community service caring for lawns at local government facilities, and have done planting at the zoo. Fischer, who is a county employee, oversees the crew.

Vegetable gardens are not the highest priority but are planted around the greenhouse. The greenhouses — there are two — focus on flower production and plant propagation from seeds. In winter women make wreaths for the facility and employees. C.O.s can purchase the flowers grown at the greenhouse and the rest are used for community and facility plantings. The participants learn day-to-day skill of a greenhouse and landscaping worker. Mr. Fischer works directly with the participants and the students are directly responsible to Mr. Fischer; there is no C.O. Students who complete the training are eligible for a community education style certificate.

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# Chapter 15: Pruning and Plant Growth

*Pruning: Trim by cutting away superfluous branches.*  
Oxford Dictionary

***“Pruning is the most difficult and rewarding part of my job and I feel that by learning to prune effectively I can improve my marketability as a gardener . . . My long-range goal is to become a tree climber”***

**— Excerpt from  
Martin Cofields HSNY  
intern self-evaluation  
form**

**P**runing is a strange blend of science and art and depending on the plant and the purpose in mind it can take place as a year round activity. Fruit trees, conifers, roses, shrubs, hedges, ornamental trees, and perennials all respond to one type of pruning or the other and the skill is an important practice in the field of horticulture. It also familiarizes students with plant growth, plant species and plant structure as well as the control and understanding of pests and disease.

There are a number of reasons why a plant needs pruning. Generally, pruning is important to shape the general growth of a tree or shrub either to promote fruit or flower growth or to keep the plant healthy and long-lived. It is also important right before transplanting or to maintain a desired ornamental shape. More specifically:

- \* Pruning away dead branches is a year- long activity and helps prevent dead tissue from rotting and becoming an avenue for pests and pathogens.

- \* Pruning fruit trees helps form strong branching and promotes better fruiting.

- \* Pruning branches from the side of structures, beneath telephone or electrical wires helps prevent damage later on.

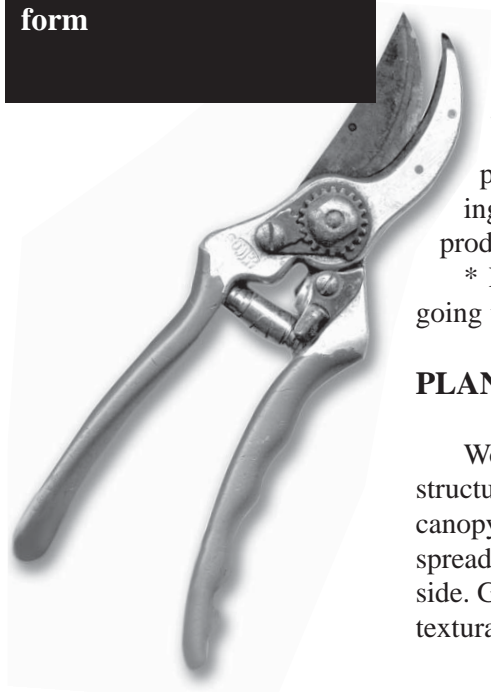
- \* Pruning hedges maintains formal shape to specific plantings and generally takes place year round as needed.

- \* Pruning shrubs and trees helps maintain the health and vigor of the plant by increasing circulation and preventing the spread of fungus, allowing more light to penetrate to lower leaves and decreaseing the damage produced by breakage.

- \* Pruning perennials promotes new blooms by preventing the plant from going to seed.

## PLANT GROWTH

Woody plants have differential patterns of growth that mark their shape and structure in the landscape. Trees can be conical with a specific leader or the canopy can be spreading in horizontal planes. Shrubs can have compact shapes, spreading horizontal branches or loose sprays that fountain gracefully from the side. Garden design takes into account natural shapes which are used to provide textural interest in the garden. Pruning helps manage and maintain that growth,



and sometimes, as in the case of ornamental trees such as a weeping beech or cherry, uses selective measures to accent and exaggerate that specific form for contrasting effects.

Placing a tree with a horizontal spread next to or in-between buildings may eventually demand a hard pruning that disrupts the tree's natural shape. A tree with a strong leader —typical of plants with a conical shape — would look equally distorted should the leader (that branch with the most upward vertical growth) be cut to maintain a specific height. If a plant should have two leaders, then the weaker one should be cut to promote vertical growth of one leader. This avoids forking later on.

At all times with long-living woody plants like trees, it is essential to think of the tree's shape and growth well into the future. Pruning young trees may take some of the randomness associated with a tree's growth, but with plants for suburban homes, parks and streets, a specimen will do more than keep its shape: it will stay healthy, with less susceptibility to disease, blowdowns, and the shears of the electrical and phone company.

Even fruit trees whose pruning regime is generally focused on high fruit production should still maintain a flow to their natural pattern of growth.

Timing is everything when it comes to knowing where and when to prune. Is the shrub or tree spring or fall flowering? If it sets buds in late summer, then hard winter pruning will eliminate flowers you desire in the spring. However, late-flowering woody plants often set their buds in the spring and do well with a hard winter pruning. The prolific flowers of the butterfly bush (*buddleia* spp) take well to a late winter pruning, because most of the plant's new growth occurs in late spring. With care, the shrub will add five to seven feet of growth in a season and provide flowers all summer long.

On the other hand, by pruning an azalea, spirea or rhododendron in the fall or winter virtually eliminates the flowers set in buds the previous fall. Spring blooming shrubs are best pruned right after flowering.

**Fig. 1. Pruning**

**A student is pictured here pruning an old apple tree at the Rikers Island greenhouse compound.**

**Pruning is a science and an art. Most of the mistakes made in the garden are mistakes of pruning. The highest levels of horticultural study guides are oftendevoted to pruning.**

**Skilled pruners like Martin Cofield who is alumni of the GreenHouse project, have an advantage in the job market. Although Martin was not able to qualify for the tree pruning position he originally wanted to apply for, he was hired by Central Park Conservancy as a zone gardener. Other zone gardeners in this prestigious organization held college degrees.**



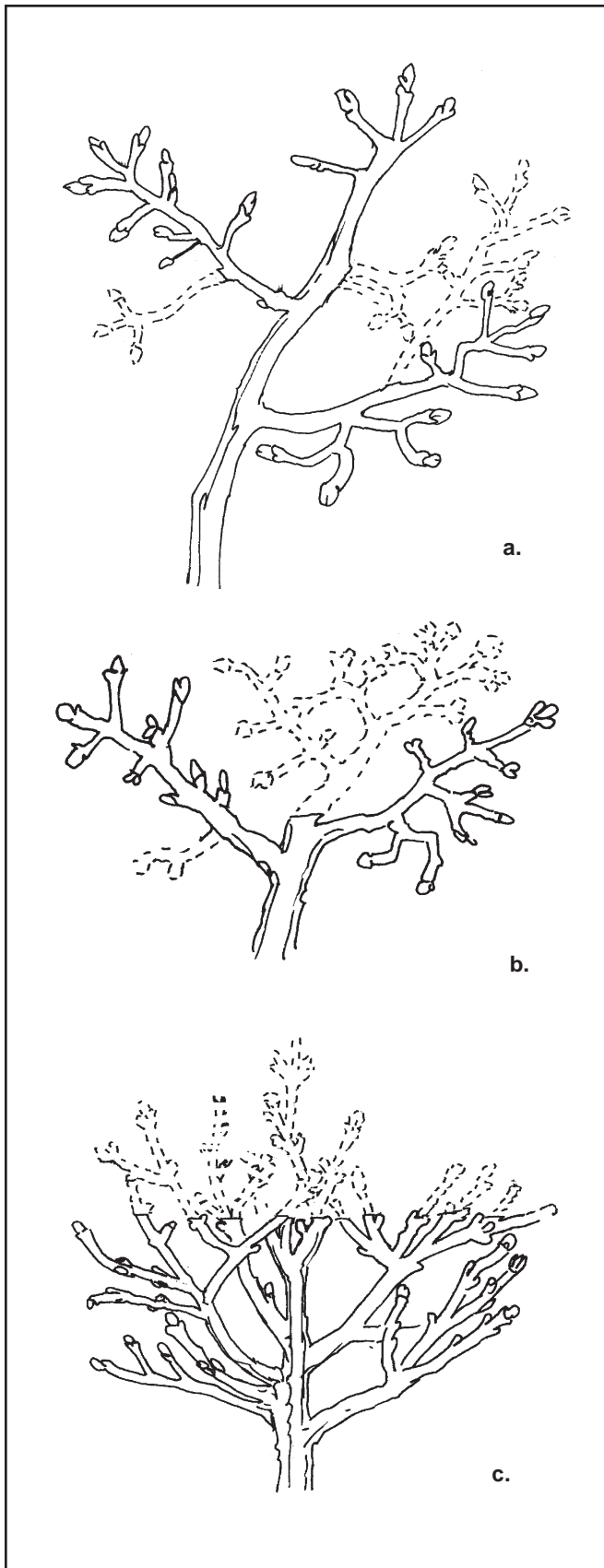
## TYPES OF PRUNING THAT STUDENTS SHOULD BE FAMILIAR WITH

**Thinning:** can take place anytime during the year to thin out dead or diseased branches, or to thin out the interior of the tree or shrub for increased sunlight and air circulation. For trees and shrubs, thinning may be cutting a limb or cane at ground level or at a branch collar. Overall, thinning adds structure and shape to a plant.

**Tip Pruning:** removing the tips of branchlets to promote bushy growth in shrubs. This is especially recommended for foundation shrubs or screens.

**Heading cut:** cutting a branch back to a side bud or shoot. This cut is used to shorten a plant and stimulate latent buds behind the cut to grow, making the plant denser. The non-selective heading cut is used to trim hedges. The selective cut reduces the overall size or height of a plant without changing its natural shape. The plant undergoes less stress without the vigorous regrowth associated with the unselective cut.

**Deadhead:** used to thin out fading or faded flowers to prevent the plant from going to seed and promoting more continuous blooms.



**Fig. 2. Types of pruning cuts**

**a. Thinning cuts** are made to the branch collar where the branch branch is growin from. Be careful not to cut too close to the collar which may damage the main branch or leave too long a stub that can become vulnerable to disease.

**b. Make the selective heding cut** just above the side branch you would like to become the new direction of growth.

**c. Nonselective heading** can be done anywhere on the stem to give the plant – often a shrub – a uniform shape.



### Key words students should know

**Branch collar:** is a bulge at the base of the branch where it attaches to the trunk. Callous cells are produced here which help seal wounds from breakage and compartmentalizes the tree against pathogens and infection.

**Branch crotch:** the angle where a tree branch meets the trunk or parent stem.

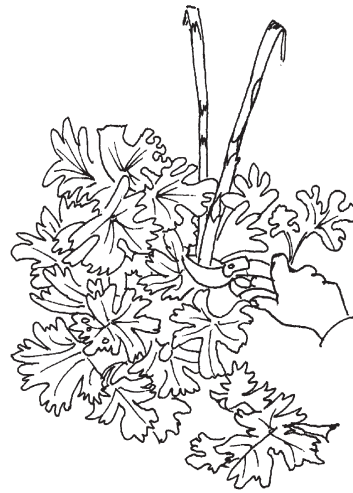
**Break bud:** when a latent bud is stimulated into growing out into a leaf or twig, it is said to break bud.

**Cane:** a long slender branch that usually originates directly from the roots.

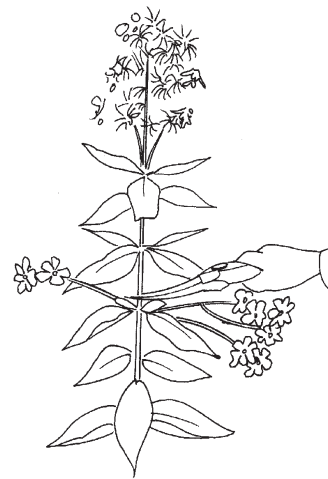
**Leader:** is the main, primary or tallest shoot of a tree trunk. Trees can be single leadered such as a birch or multiple leadered such as a redbud.

**Skirting or limbing:** up-pruning off the lower limbs of the tree.

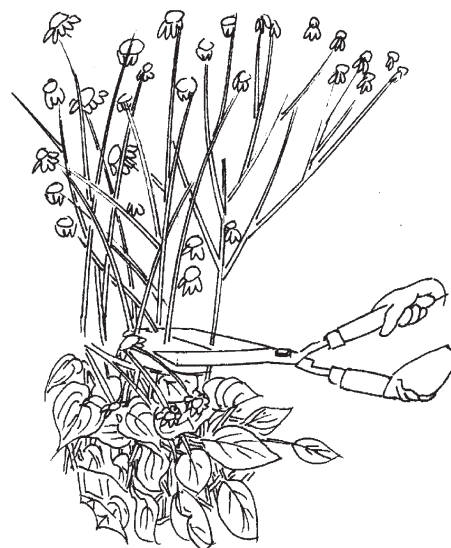
**Sucker:** an upright shoot growing from a root or graft union. They are also straight and rapidly growing shoots or water sprouts that grow in response to wounding or poor pruning.



a.



b.



c.

Fig. 3. deadheading perennials

a. Delphiniums and hostas need to have their stems cut back once they are done flowering to help them produce additional blooms.

b. The side shoots of phlox will flower once the uppermost spent flowerheads are cut away.

c. In Fall, cut back rudbeckia to about 2/3 of the overall height of the plant in mild winter areas and about 1/2 in areas of harsh winter.

## PLANT GROUPS

### Perennials

Certain perennials respond to deadheading for repeated blooms, including echinacea, achillea, coreopsis spp. and gaillardia, while others such as papaver, astilbe and assorted bulbs bloom only once before the stalks should be removed. The chart below indicates the proper maintenance for common perennials in a temperate zone garden.

### Roses

Roses can be pruned for cut flowers during the bloom period, taking into account the proper cut to an outward facing bud. Heavier pruning should take place during the late winter when the plant enters its dormant phase. Prune all diseased, dead or sun scalded branches. Canes with dead wood should be removed as well as inward facing branches. If reducing over-grown shrubs, thin out the older wood, gradually maintaining a balance between 1 to 3 year growth.

### Flowering Shrubs

Spring flowering and summer flowering shrubs should be distinguished before pruning. In winter during the period of dormancy, shrubs such as different species of roses, and wigelia, buddleia, and berberis can be pruned relatively close to the ground. Shrubs such as azaleas and rhododendrons should be deadheaded after flowering in Spring and selectively thinned of old wood or dead and diseased branches. Other quick growing, spring flowering shrubs such as forsythia and spirea spp. can be pruned more heavily after flowering to create more compact growth through the summer.

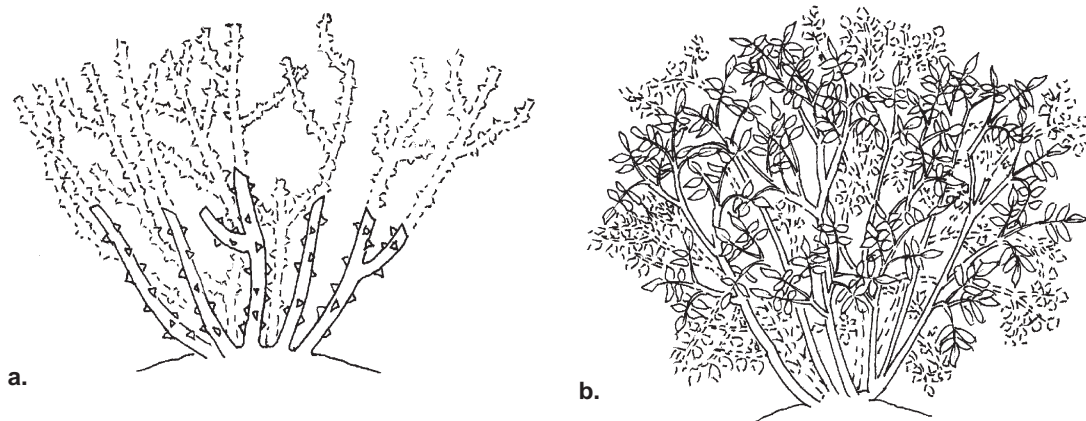
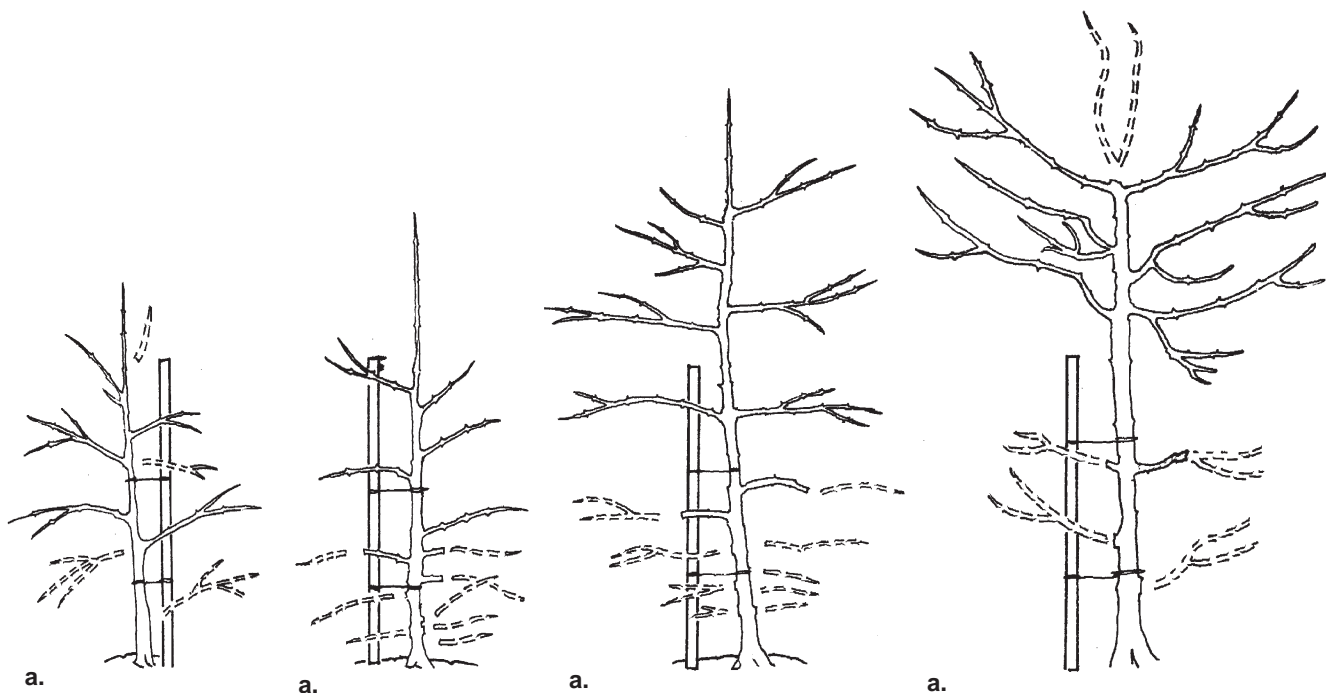


Fig. 4. Pruning Roses.

a. Hybrid account for the majority of standard roses. They produce best at a height of 2 – 4'. Prune back by about 1/2 in either fall or spring. As in all pruning, remove dead and spindly growth up to a healthy bud. Reduce the number of side shoots by about 2/3. The overall height of the plant can be recuded to about 1 – 1 1/2'.

b. Those roses, with dense tangles of shoots, need to be pruned throughout the season. At the end of the season 1/4 of old growth can be cut away to encourag new hardy stems. Remove spent blooms regularly; prune out twiggy growth. Prune the height by concentrating on the side shoots. It's better to leave the main shoots alone except in the case of damask-like roses.



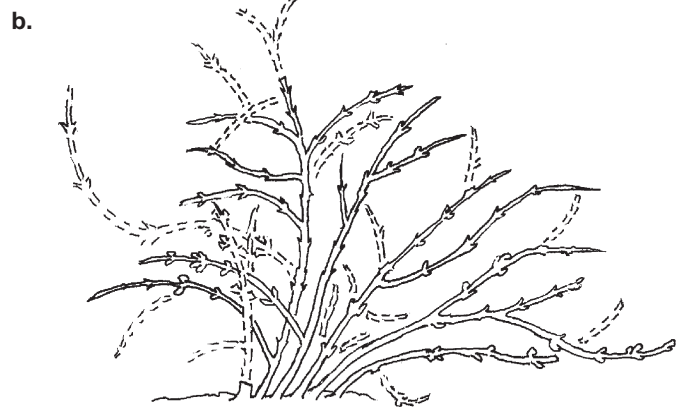
**Fig. 5. Pruning and training young trees**

**a.** At the time of planting, carefully position the young tree so its best side is foremost and its main stem is straight. Remove small or damaged branches.

**b.** At 1 year, cut back the side branches on the lower part all the way to the main stem. Cut back the branches directly above them by about 1/2. This will begin to give the young tree its shape.

**c.** Continue to prune back bottom branches all the way in the second and third years. Cut middle branches by about 1/2.

**d.** Later on, you may decide to train your young tree to spread its upper branches out by cutting back the leader to a healthy bud. Continue to prune away the bottom-most branches while cutting the middle ones back by about 1/2.



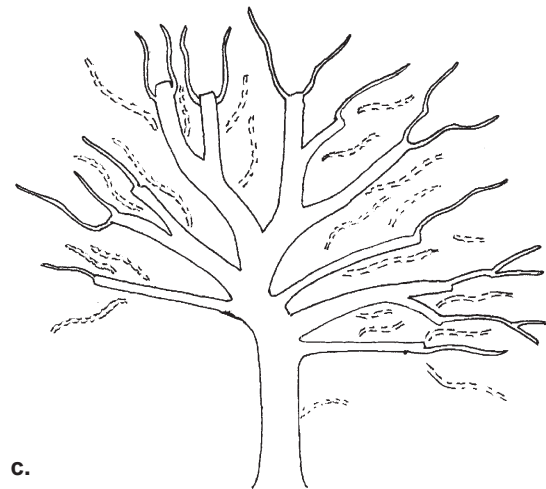
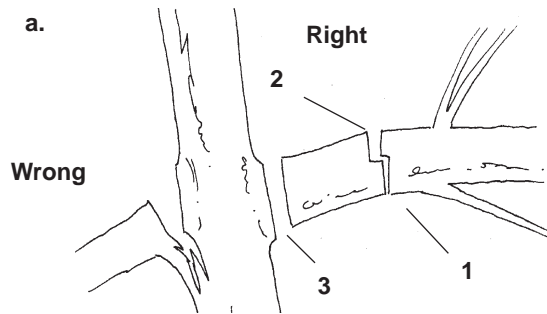
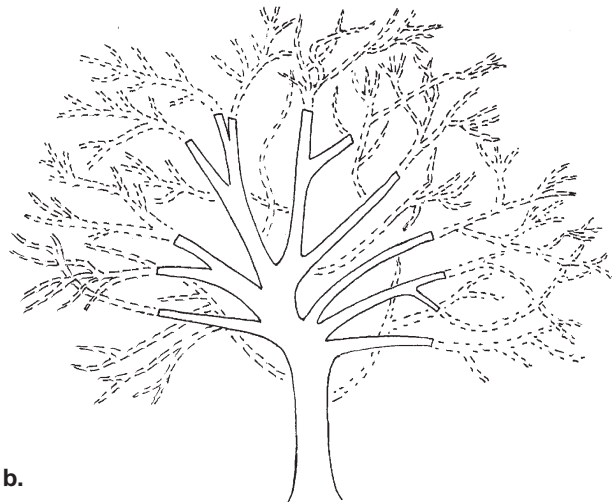
**Fig. 6. Pruning flowering shrubs**

**a.** Pruning climbers like some clematis and honeysuckles in the late winter or early spring gives the new growth which will produce the flowers time to develop.

**b.** Shrubs and climbers that flower on last season's shoots like Forsythia, hydrangea and some jasmines should be pruned right after flowering.

## Evergreens and large trees

**Large Trees:** Should be pruned during their period of dormancy to minimize the risk of pathogens and disease. Dead branches and branch stumps should be cut back to the nearest stem or trunk using the Three-Step-Method (see illustration). Always limb up and be wary of topping the leader. Take into account the branch bark collar where the tree produces callous cells that seal off wounds and compartmentalize any potential infection.



**Fig. 7.**

**a.** Use the 3-step pruning method for large limbs to avoid bark splitting. 1. About 1" from the branch collar make a cut half way through the branch. 2. About 1/4" closer to the branch collar make another cut from the top. 3. Remove the branch and finish with a clean cut close to the collar.

**b.** Old trees can have dead, rubbing, or damaged branches. Removing them improves the tree's health

**c.** The branches that were stimulated to grow by the pruning can be thinned out the year after. It might be necessary to prune again yearly once or twice more.

### A Tip for Students

The plant pruning guide on the opposite page was created by Martin Cofield, while he was an intern with HSNY, under the guidance of Trish Daniel, the head gardener of The Horticultural Society of New York's GreenBranches library gardening and education program. It is a valuable tool used and expanded by subsequent interns. It is so important for students to learn to document the research they do as a way of internalizing and formalizing the lessons learned.



<b>Tree, shrub, creeper and perennial pruning manual</b>	
<b>Trees</b>	
Shadblow, Shadbush <i>Amalanchier Canadensis</i>	Prune in late winter or early spring when dormant. Remove wayward or crossing shoots.
Dogwood <i>Cornus Kousa</i>	Prune annually after flowering on established plants; cut back about 1/3 to 1/5 of old shoots to the base, to promote replacement growth.
Chinese Juniper <i>Juniperus chinensis</i>	Junipers need little if any pruning.
<b>Shrubs</b>	
Barberis <i>Berberis Thunbergii</i>	Prune annually after flowering; trim or lightly cut back shoots that spoil symmetry
Buddleia <i>Buddleia davidii</i>	Cut back to low permanent framework. For old shrubs, and drastic renovation, cut back all flowering stems close to the base.
Hydrangea <i>Hydrangea macrophylla</i>	Remove unwanted stems in winter.
Holly <i>Ilex aquifolium</i>	Prune free-standing specimens to shape in the early years; only clip formally grown plants in summer, trim hedges in spring.
Coast rose <i>Rosa rugosa</i>	Prune in the summer after flowering, prune main stems lightly, or cut back by up to 1/3 as necessary.
Bridal veil <i>Spiraea japonica</i>	After flowering cut back all flowering; stems close to the base.
English Yew <i>Taxus baccata</i>	Trim hedges in summer and early autumn; can withstand renovation pruning.
English cranberry bush <i>Viburnum opulus</i>	Prune annually after flowering. Remove dead and damaged growth in mid-spring.
<b>Creepers</b>	
Creeping Myrtle <i>Vinca minor</i>	To restrict growth, cut back hard in spring.
Boston ivy <i>Parthenocissus tricuspidata</i>	Prune annually, or as needed: after flowering, if flowering on previous year's growth. From late winter to spring, if flowering on current year's growth.
<b>Perennials</b>	
Lady's Mantle <i>Alchemilla Mollis</i>	Prune back and water in summer to produce a fresh new flush of leaves in autumn.
Touchseed <i>Coreopsis rosea</i>	Deadhead to prolong flowering.
Nipponanthemum <i>nipponicum</i>	It performs best when cut back almost to the ground in spring; unpruned plants quickly become leggy and unattractively open-centered, divide in spring.
Sedum <i>Sedum herbstfreude</i>	Cut back spreading species after flowering to maintain shape.
Fountain grass <i>Pennisetum alopecuroides</i>	Cut back dead top growth by early spring.

## **Jacksonville Correctional Center Profile**

Depending on the demographics of a horticulture program's population, some students may have the skills of horticulture, agriculture, carpentry, masonry, electrical or plumbing that are needed by a garden maintenance crew, some on a professional level. These students are invaluable, as peer teachers and in managing the day-to-day operations. Most programs have assignments within the facility that they are responsible to complete. It's great to see these students return to their occupations once they are home.

Sometimes people from entirely unrelated backgrounds will develop love of gardening to a point where they can make career changes or successfully obtain first-ever serious jobs.

At the Jacksonville Correctional Center in Jacksonville, Illinois, the MacMurray College has established a school at the facility. Students can obtain a one-year certificate after 34 completed semester hours. There is also an Associate of Applied Science Degree that requires 63 semester hours of course work. Tropical greenhouse plants decorate the facilities offices when they are not serving duty as propagation specimens or teaching plants. Bedding plants germinated in the greenhouse serve the same purpose. The flower beds are tended by students alongside inside grounds workers.

The MacMurray College brochure states: "A career in Horticulture provides opportunities for employment as a landscape designer, grounds superintendent, golf course superintendent, turf manager for construction contractor or highway department landscape associate and nursery operator. Students should have the potential to operate their own business or advance in the field."

Students who enter the landscape maintenance crew obtain the privilege of working outside the fence. Landscape maintenance is the most advanced class given in the MacMurray one-year certificate program. And one of the most advanced tasks in landscape maintenance is identifying identifying proper techniques of woody plant removal. This task preceded by identifying reasons for pruning; identifying types of woody plants; physical and environmental damage and corrective procedures; pruning trees, shrubs and vines and proper techniques of cabling, bracing and cavity work on trees. Students who complete these advanced levels of garden skills obtain marketable skills.

Pruning takes a steady hand, an audacious sense of design, and a dead eye. It is the backbone of landscape maintenance. Pruning is akin to surgery and has many parallels with that mystery. Pruning is a science and an art. Properly pruned plants show at their best, are healthy, and sometimes in severe situations can even be renovated. The most common mistakes in the garden are often pruning mistakes. Many home gardeners consider pruning to be too difficult to do themselves. The only cure for badly-pruned plants is time. Often these mistakes can only be remedied over a period of years.

### **Three case studies of individuals who affected career changes in mid-life.**

Although there is no formal tracking of where people go when they complete the horticulture program, Sherry Fraley, MacMurray Horticulture, Jacksonville Correctional Center, Jacksonville IL wrote to tell us about three former students who used their landscape maintenance skills to make career changes in mid-life in part because of their involvement in the MacMurray program.

An ex-meat cutter with eighteen years of experience in that field was able to obtain a job with a local landscape company within one week of his release. He worked there for approximately seven years eventually becoming the crew's foreman. In the meantime, he had built his own greenhouse and was growing bedding plants for the local businesses of his hometown to retail. In the winter months he made wreaths and grave blankets and marketed them.

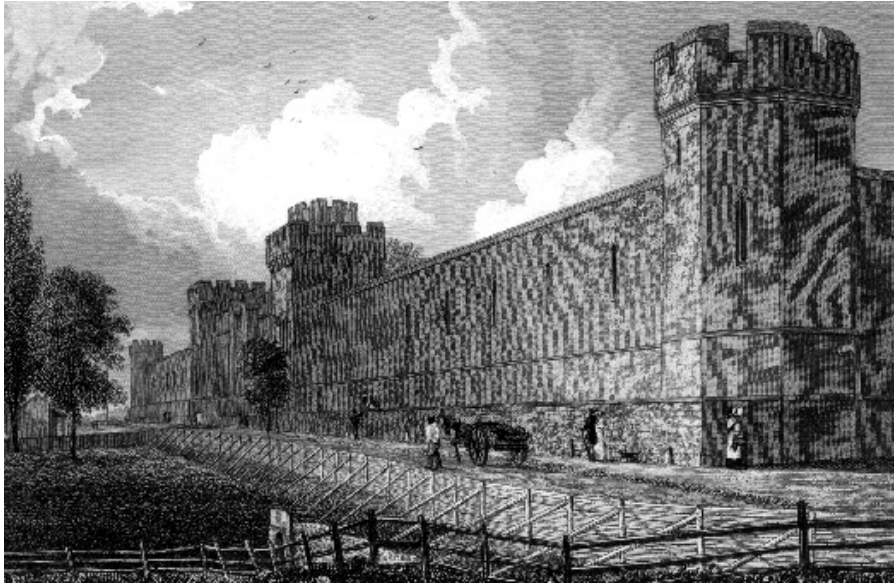
For the past three years he has been working off of a state or federal grant growing and maintaining gardens for counties, working with local seniors and the needy. He did not apply specifically for this position; they came and asked him to.

An ex-restaurant owner/operator went to work for the large chain of Frank's Nursery Stores within a week of his release. The store started him on the loading docks and bagging Christmas trees. His landscape and nursery maintenance skills were so unmistakable that soon after he began he was moved to a Department Manager position, taking several departments from red to black. Just recently, he has started his own business called Plant Rescue. He charges for house calls, trouble shooting landscape problems for suburban homeowners in his area.

The third former student, an ex-oil rig operator, also found work within weeks of his release in a parks district near his home. As important as finding work, he was able to keep it. Since then he has been in touch with the MacMurray program to research some horticultural information. He had just received an unsolicited job offer from a private landscaping company.

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# *Appendix*



## **History of Prison Horticulture**

Around the turn of the century, a man by the name of Canada Blackie was convicted for his part in a bank robbery in Cobleskill, New York that left a bank guard dead. He was sentenced to life in prison. Blackie spent his first 7 years in Clinton Facility, a maximum-security penitentiary in a remote corner of upstate New York, with a clean record. But soon after followed a stretch of turbulent years that found him spending long periods of time in solitary confinement. At one point, using a piece of gas pipe, metal scrap and matches, Blackie fashioned a gun which he used in an attempt to escape. He shot a guard, was captured and received an additional 10 years on his life sentence. He served the next year and eight months in the "dark cell" sleeping on a stone floor without bed or blankets. When he finally got out he was blind in one eye and had contracted tuberculosis. Undeterred, Blackie was again caught with contraband material, this time dynamite that was somehow smuggled into the prison.

He was finally transferred to Auburn Prison and placed in solitary confinement where, during a tour by the new warden, Thomas Mott Osborne, Blackie had a life-defining moment. Osborne was known for his reform agenda, having once incarcerated himself at Auburn to experience firsthand conditions at the prison. As he stopped by Blackie's cell, the prisoner inexplicably handed him a makeshift key. Osborne tried the key and it worked; the cell door opened. For "going straight", Osborne rewarded him with a walk from solitary confinement to the main yard which Blackie later recalled in his journal:



After traversing the corridor of the isolation building, we came to the double-locked doors - two of them, which lead directly into the main prison yard; as I stepped into the pure air, I felt as though I wanted to bite chunks out of it, but the first deep inhale made me so dizzy that I actually believe I would have staggered had I not taken myself into firm control. On rounding the end of the cloth-shop, we came into full view of the most wonderful, as well as beautiful, sight I have ever seen in prison, – or outside, either, for that matter.

I hardly know how to describe this sight: but picture to yourself, if you can, fourteen hundred men turned loose in a beautiful park. For years previous to this good work now being promoted by Mr. Osborne and the prison officials, these same men who I now see among the beautiful flower-beds, instead of the prison pallor and haunted look which once predominated, I now notice smiling eyes, and the clean look which exhilarating exercise in the pure air always brings to the face.

As a reformer Osborne knew that most inmates would eventually be released, and ex-offenders, broken, bitter and damaged in health, were not likely to lead a life as productive members of society. Osborne sought to break the culture of incarceration by introducing education, work and religion to the prison system. Inmates were also given time for outside recreation, more nourishing food and less arduous work conditions. He also transformed the bleak prison grounds of Auburn by creating gardens in the prisoners' yard. This humanizing touch helped quell the anger and often violent behavior that took place when inmates milled freely about in the large Auburn yard.

The role of horticulture today in prison is marked by Osborne's vision, but to understand why horticulture is valued in corrections it is useful to understand something of the history of prisons.

## **History of the Prison System**

The penitentiary system as we know it today has only been in existence for about 150 years. Established in the early 19th century, the state penitentiary marked the end of torture, death or banishment as the usual penalties for criminal behavior. Taking its place was a revolutionary concept which simply introduced the loss of liberty as punishment for criminal behavior.

Ironically enough, while the penitentiary system, as a concept was new, jails and prisons have always been a part of both America's history and development. Columbus sailed for the Indies with four convicts among his crew. Columbus later went on to send back hundreds of Indian captives as prisoners on subsequent voyages to Hispanola, thus, effectively establishing the slave trade to the New World. Columbus himself was eventually brought to Seville in chains, summoned by the Spanish Inquisition. After a period of imprisonment, he was stripped of all his powers. Other explorers to the New World brought more convicts and later Africans whom they held as prisoners. As settlements began to be established, these prisoners were left behind as agricultural workers.

The practice of keeping conquered foes as slaves was well known among certain Native American tribes such as the Cherokee. With them, the term “slave” and “prisoner” were interchangeable. Women and children were generally adopted. Braves and young men were generally tortured and killed. Around the turn of the 19th Century, Joseph Brand, a Mohawk leader who had fought for the British in the revolution, was imprisoned for killing a white man during an interrogation. Brand defended his people against claims they were far less civilized than white people, using the white man's concept of imprisonment as their yardstick criteria:

Among us we have no prisons. We have no pompous parade of courts; we have no written laws, and yet judges are as highly revered among us as they are among you and their decisions as much regarded . . . And will you ever call the Indian nation cruel? Liberty to a rational creature, as much exceeds property as the light of the sun does that of the twinkling star. I had rather die by the most severe tortures ever inflicted on this continent, than languish in one of your prisons for a single year.

The rise of the penitentiary system coincided with the period of time that saw an erosion of aristocratic power in many parts of the Western world. In Europe, prior to the framing of the democratic laws of the United States, all crimes were considered direct affronts to the order and power of God as well as to the sovereign head. The power to punish originated in the infinite power of the monarchy ruler. Liberty was a privilege reserved for the aristocracy while peasants had neither material nor personal freedoms in an open court of law. Revolution, including the successful rebellion in the British colony in America, transcended this notion and began to make personal liberty a human right. As political freedom became both a social and moral value, the notion of withholding liberty for criminal acts gained greater acceptance among the rising corps of civilian law enforcers.

### **Horticultural Beginnings**

Yet, in 1789, just as the penitentiary system was being established in the U.S., in Europe, the death penalty was being administered for crimes of a wider variety and less serious nature than ever before. With the wane in aristocratic and sovereign control, lawyers and philosophers began arguing for punishment that did not entail public displays of torture, floggings and executions. Government regimes were equally wary of large gatherings that whetted the public's notion of justice and could quickly turn on the regime itself. Thus, while parliament kept adding to the list of capital crimes, the number of persons executed actually decreased. Most of those condemned to death during the eighteenth century were pardoned for the purpose of providing labor to the large plantations in the New World.

The policy and its economic purpose were clear from the start. In 1607, during the settling of Jamestown, the new colony discovered its financial salvation in a weed native to the Virginia region. First brought to Europe by Columbus, tobacco by the early 17th century had a value that was said to equal silver. For English growers and entrepreneurs, tobacco had the early potential to transform the impoverished colony of Jamestown into a lucrative venture. Once a non-bitter tobacco hybrid was produced with seeds from the Caribbean, Virginia was poised to export the colony's first cash crop. To be successful, the small settlement needed to develop an entire infrastructure devoted to the growing and trade of tobacco. Roads, wharves, fields and warehouses had to be constructed in a wilderness town with less than 2000 residents.

The British Government stepped in and declared by a royal commission that any felon, except those convicted of murder, witchcraft, burglary, or rape, could legally be transported to Virginia or the West Indies to become servants or workers on the plantations. In one case a man was pardoned of the death sentence because he was a carpenter and the plantation needed carpenters. The King had already begun sending children away as servants and apprentices at the plantations. The colonists were also encouraged to take as prisoners the children of natives for conversion to Christianity. Presumably, the native children were valued for their knowledge of local plants, without which the colonies would never have been able to survive.

The infusion into Virginia of kidnapped children, maids, convicts and Africans, all to work as servants on the plantation marked the beginning of a pattern that would continue for nearly two centuries. By 1650 most British immigrants to colonial America went as prisoners of one sort or another.

### **Prison Infrastructure**

The first House of Correction for colonists was erected in 1632 by the Massachusetts Bay Company charter. The purpose was to both punish offenders and deter others. At this time, Boston consisted of less than forty houses. Contemporary accounts describe it as a "house of meager looks and ill smells." Among those the puritans of Boston considered to be the most threatening and dangerous were "witches" and Quakers.

The Quakers, however, soon obtained a royal charter to begin a new colony called Pennsylvania, one that would offer complete religious freedom and a criminal code that avoided bodily punishments in favor of imprisonment. The founder, and future governor, William Penn, had himself been incarcerated three times and would die in London shortly after his release from jail where he was imprisoned for debt.



### **Role of Prisoners in American Society**

Indentured prisoners and slaves brought more than skills and labor with them. Cotton Mather, the Puritan preacher recounts how African slaves had explained the method used in their homeland of preventing small pox by administering a small amount of the pox's secretion into a small wound made in a healthy person's body.

The treatment worked. Later on, Dr. Maitland accordingly inoculated six Newgate felons in the first formal experiment with the new vaccine. Again it worked. The prisoners who were human guinea pigs and the slave who carried the technology to the colonies received no credit for the discovery.

Along with William Penn, the first convicts made significant strides and contributions to the new colonies apart from hard labor. George Washington was tutored by a convict. Anthony Lamb served out a sentence in Virginia and later made his mark as a prominent optician and maker of mathematical instruments. His son John was a general in the Continental Army. John Hones van de Huville practiced medicine in Prince Georges County, Maryland with his master's permission. Patrick Colquhoun, a Scotsman and a convict involved in the slave trade became well known as a police official and banking expert. Years later, he said many former convicts had risen to positions of prominence:

"Possessed in general (as every adroit thief must be) of good natural abilities they availed themselves of the habits of industry they acquired in the years of their servitude – became farmers and planters on their own account . . . acquired that degree of respectability which is attended to property and industry; but also in their turn became masters."



Indentured servants lived only slightly better than convict laborers and usually served a term of 14 years under an absolute master. Sometimes they were taught trades; more often they were merely labor for the plantations. At the end of their time, they received freedom dues. In 1640 this reward consisted of "one good cloth suit of kiersy or broad cloth, a shift of white linen, one pair of stockings and shoes, two hoes, one axe, 3 barrells of corn and 50 acres of land."

The released servants learned the farming skills that allowed them to survive while they were bound on the plantations. During this period, an indentured servant could expect to labor six days for his master, and on the seventh he was allowed to work on his own garden. Of course, slaves had no rights and were considered to be the chattel of their masters. Their children as well had no hope of ever becoming free.

With such a proportionately high number of residents in some form of bondage, there were equally a large number of escapes. Holding cells were constructed in almost every colony to detain captured runaways. "By the 1720s every city and virtually every county had at least one detention house, and most had several. Colonial America had more jails than public schools or hospitals."



These were hardly jails: built cells with little more than a vermin-infested bed of straw on a cold stone or plank floor, usually in a 6 by 12 foot room in which up to 10 inmates might be crowded. It was not unusual for prisoners to starve to death or be subject to swift outbreaks of disease. Medical care was almost non-existent. The overall conditions of the country's nascent jails served as reminders of the misery which awaited run-aways and lawbreakers.

### **State Penitentiaries**

The end of the Revolutionary War witnessed a change in housing for prisoners, beginning with reforms enacted in the Quaker-run State of Pennsylvania. There, legislation created a "penitentiary-house" consisting of solitary confinement, hard labor and the provision of "coarse clothes" and "inferior food" for incarcerated inmates.

After touring Philadelphia's Walnut Street Jail, Thomas Eddy, a former Pennsylvania Quaker, Tory, tobacco trader and finally a New York businessmen, helped draft penal laws for New York State. The laws eliminated the death penalty for all cases except state treason, murder and stealing from a church, and abolished whipping as a punishment for crime. Judges were able to use broad discretion in sentencing convicts to hard time and legislation called for the construction of two state prisons.

Eddy was enlisted as part of a committee to construct the first prison. The spot they chose was built on the Hudson River, almost a mile and a half from City Hall at what today would be the end of Christopher Street in Greenwich Village. The walls were 23 feet high with matching watchtowers, two story buildings and a handsome cupola with a bell to sound an alarm. Eddy brought in a number of reforms, including a chapel where inmates could worship. He separated men from women and older felons from younger felons. He also abolished torture and embraced communal cells with a few segregated cells for solitary confinement. It was finished in 1799 at an entire cost, including land, of \$208,846. This was the first significant capital construction project in the State and its greatest public expenditure.

The first convicts arrived in November, 1797. There was Richard Dawson, a 28 year old white carpenter serving a life sentence for burglary. Then, David Green, a clerk from England sentenced to life for forgery. In that year, 123 persons were committed to the prison. Cleanliness was a much-enforced rule, as were the rules banning swearing, vulgarity and quarrelling. Within the second day, inmates were assigned to work in Eddy's introduced factory system making shoes and boots. One convict who was a cobbler was assigned to instruct other inmates. Eddy also encouraged inmates to use their existing work skills at tailoring, weaving, cooking and gardening.

### **Horticultural Programs**

Prison horticulture may be viewed as an outgrowth of the prison reform policies of the late 20th century. However, beginning with the establishment of state-run prisons in the early 1800s, inmates

were required to grow food as a way to offset the cost of their upkeep. More punitive than programmatic, the early prison farms consisted of long hours, harsh conditions and the steady demands of prison quotas. Despite their severity, prison officials recognized that inmates exposed to the outdoors, hard work and fresh food were less likely to cause problems in jail than inmates locked in their cells all day. In the 1840s, prison building flourished with the idea of transforming the prison from a "physically and morally filthy place of confinement into a clean and rationally functioning reform-machine."

The idea was that a strict diet of work and military discipline would help turn criminals into law-abiding citizens. The optimistic belief in the new prison based on uniformity and impersonality was widespread. One prison chaplain insisted: "Could we all be put on prison fare, for the space of two or three generations, the world would ultimately be the better for it."

State and Federal penitentiaries were often located in rural areas far from urban centers, on land that lent itself to crop production and animal husbandry. Many facilities were actual farms before they were bought to house corrections. Angola Penitentiary, a maximum state facility in Mississippi, a former plantation, is the largest working farm in the state today with 18,000 acres. Rikers Island, a small island in New York City's Flushing Bay and now the largest jail complex in the country was once a farm owned by the Rykers family. When the island was sold, the City used it first as a prison farm to grow food for the city's major jail which was then on Blackwell's Island. Today, despite its proximity to Manhattan, the Island's 9-acre farm produces up to 40,000 pounds of produce annually.

In addition to farming, landscaping and horticulture were adopted to soften the harshness of the prison environment. The notorious Sing Sing Penitentiary in Ossining, New York for example, became a model of progressive reform in the mid-1930s with the construction of a hospital, library, classrooms and gymnasium. The crowning emblem however, was the establishment of expansive gardens and landscaped buildings on the prison grounds, all done by inmates led by a former New York City newspaper editor serving a life sentence for murder. Called the "Rose Man," he became an ardent bird enthusiast after he noticed birds roosting in the prison's trees. He eventually raised funds from former business associates as well as inmates to build a huge birdhouse on the prison grounds, among Sing Sing's gardens. After his death, the house deteriorated and in 1946, was demolished.

Not far from Sing Sing, in Westchester County, the Bedford Facility for Women opened in 1901 and quickly established an ethos of prison reform that would influence the future of U.S. corrections. Under the administration of jail superintendent Katherine Bement Davis, Bedford required inmates to not only work, but attend school. Basic math, reading and writing were taught along with mechanical drawing, stenography, typing, chair caning, bookbinding, painting and carpentry. Davis gave singing lessons, the assistant superintendent taught gymnastics class and the physician gave weekly talks on physiology and sex hygiene. In summer a recreational instructor was employed.

Davis also stressed outdoor work and the "fresh air treatment" as a way of both promoting health, and producing food. Inmates milked cows, raised chickens, and slaughtered pigs to supply all their own milk, eggs, pork and a good quantity of their beef and vegetables. They also planted trees and maintained flower gardens in front of the facility's four cottages.

## Alcatraz Island

While working with plants was thought to have a socializing impact on inmates, the same could be said of the inmates' impact on the harsh prison landscape. One needs to look no further than Alcatraz, the former maximum-security prison built on an eleven-acre island in San Francisco Bay.

Here, amidst buffeting winds, the cold fog and the occasional Pacific storm, the warden, together with the officers and inmates undertook the god-like task of transforming a bleak, rocky outpost into a contoured landscape of gardens and flowers. Dynamiting steep rocky slopes, carting in tons of soil from the California mainland, the residents carved out terraces to cultivate a site that once was nothing more than a bird and seal rookery.

Early on, as a military prison, the creation of gardens made Alcatraz somewhat bearable for prison staff and their families. Victorian gardens were created prior to 1870, during the Civil War, when the island was peopled with rebel sympathizers and soldiers, Union deserters and captured Native Americans.

As early as 1915 the army developed a progressive vocational and rehabilitation program aimed at prisoner rehabilitation. In 1917 the Alcatraz newsletter, *The Rock*, reported "that a training program had begun that provided eight men with experience and skills to become gardeners."

Across the island, inmates cut deep holes in the rock, filled them with soil and planted roses, sweet peas and lilacs. For the next 50 years, long after the island became a federal penitentiary, both staff and inmates played a dramatic role in expanding the plantings and gardens on Alcatraz.

One of the more influential gardeners on Alcatraz was Freddie Reichel, secretary to Warden Johnston from 1934 to 1941. Reichel was taken by the army's efforts to beautify the island and soon began to spend his free time maintaining the existing beds and expanding the gardens. He took over the rose garden, the greenhouse, the slope behind his quarters, and the small flat garden near the post office. Reichel brought with him to Alcatraz little horticultural experience, but by the time he left he was an expert self-taught gardener. Isolated, yet no less than a half-mile from the San Francisco, he enlisted support from some of California's top horticulturists.

Capitalizing on the island's wet winters and dry summers, Reichel brought in succulents such as aeonium, aloe, century and ice plants as well as a variety of bulbs. Eventually, he convinced the Warden to allow trusted inmates to work with him in maintaining and planting the Alcatraz gardens.

One of his proteges was Elliot Michener, who arrived as a prisoner on Alcatraz in 1941. Michener spent 7 years constructing his garden which he wrote about in the following account:

My gardening work began with planting the strip of hill beside the steps with mesembryanthemum, so that all of the hillside would be the same - pink laced with (yellow) oxalis. The terrace - six to ten feet wide on either side of a curbed, graveled road - had been gardened apparently for many years, but under difficulties. Nowhere was the soil more than four or five inches deep. Under that was solid yellow hardpan.

I undertook what turned out to be a two-year task : breaking up the hardpan to a depth of two and a half feet, screening it, fertilizing it with thousands upon thousands of five-gallon pails of garbage lugged up from the incinerator and disposal area . . .

A life-long friend . . . Richard C. Franzen, AZ-387, gardened on the other side of the island. He had a very small greenhouse and a small garden which I never saw. Dick was a happy-go-lucky farm boy who had a good knowledge of how to grow plants.

The products of his work were glorious bouquets that Michener gave to the Warden's wife. She in turn provided him with seeds and flowers.

The prison closed in 1963 and pounded by the harsh Pacific winds soon deteriorated into a complex of gutted concrete buildings, broken asphalt and half-standing pitted walls. But where nature destroyed it also reclaimed. The carefully tended gardens overran their terraced walls, their seeds carried by wind and their berries spread by birds. Habitats emerged. Nature quickly reclaimed the island for itself . . . Once a barren, guano-covered hump, Alcatraz had been transformed and is still transforming into a dynamic community of animals and plants, an evolving system of native and naturalized exotic trees, shrubs, perennials, annuals, grasses and ground-covers. The composite ecology of Alcatraz is a testament to the stories of the island's residents, the men and women who for almost a century and a half resided there, for despite the misery and harshness of their surroundings, they spilled their creativity into a living mosaic of nature and beauty.

And the inmates? In 1950 Michener was released from prison, claiming that gardening had released him from the stress of prison life.

"The hillside provided a refuge from disturbances of the prison, the a release, and it became an obsession. This one thing I would do well . . . if we are all our own jailers, and prisoners of our traits, then I am grateful for my introduction to the spade and trowel, the seed and the spray can. They have given me a lasting interest in creativity."

Michener, like others before him, recognized intuitively the restorative benefits of plant care. Yet, in the prison environment, and the newly emerging world of corrections, the words were not yet formulated to naturally articulate the need for benevolent programs like horticulture and gardening.



## **Making a Difference through Gardening**

*By Cathrine Sneed*

Every year, in San Francisco and across the country, thousands of people pass through our country's penal justice system. If you work in this field, you know the numbers. Today's trends in criminal justice call for all the rest of us to give up on these people. The criminal justice system is based on the idea that there are people society has no hope in changing. Such hopelessness is not about our lack of faith in that person, but is really about our own lack in our humanity. How much we spend on our criminal justice system shows how much we have given up. Instead of national trend, it should be a national shame.

Because these people never had a chance. I know the people I work with have lived in households that for generations have never seen a paycheck. I know most of them read and spell at the third grade level, though they may be in their twenties or thirties. Society fails them from the beginning – giving them a free ride to the city jails rather than the city college.

These are daunting facts. When I became a counselor at the San Francisco County Jail in 1980, I wondered how I could impact this cycle. My friend the author and poet Wendell Berry wrote, "Out of a history so much ruled by the motto Think Big, we have come to a place and a need that requires us to think little." The idea for this program began simply. When I first came to the San Francisco Sheriff's Department, I worked as a counselor. Every day, I tried to convince the prisoners that just because they had done bad things, they were not bad people. They continued to return to jail. What I was telling them was not enough. It also was not enough to let them go with the clothes they came in and bus fare and expect them to change their lives. They needed to find a sense of purpose in their lives – a connection to something beyond themselves. I had just read *The Grapes of Wrath* by John Steinbeck and thought if the families in that book could find hope in the land, so too, could the prisoners. I had nothing else to offer them. I knew their lives were at stake and that I had to begin somewhere.

Beginning somewhere is enough: the economist E.F. Schumacher once wrote, "Perhaps we cannot raise the winds. But each of us can put up the sails so that when the wind comes we can catch it." Since 1982, I have been director of a gardening program for prisoners in the San Francisco County Jail and a post release program called The Garden Project. It is not a huge program, although over the years we have worked with thousands of individuals. Over their time with us, they learn many things. They learn to grow food and to plant trees. They learn to be at work on time and to respect others. They give back to the communities they had taken from and they earn a paycheck. There are other things they learn – things I cannot teach them, that transcend their day-to-day work and give them back their lives, their humanity. Since our post release program began in 1992, we have literally changed the face of San Francisco's poorest neighborhoods: we have planted over 7,000 trees and the vegetables we grow feed hundreds each week. The Garden Project works: Garden project participants are less than 25% as likely to return to jail as non-Garden Project participants. So we don't just grow plants, we grow people too. We've put up our sail.

## **Greenhouse to Green Streets**

*By Liz Lynch*

Through the spring and summer of 1998, I was a resident of Dorm 19 at the Rose M. Singer facility for women at Rikers Island and decided to enroll in the Rikers Island horticulture program. I wanted to learn about plants and gardening which was something I had always enjoyed. I thought that working in the greenhouse and gardens would be a good way to help relieve the stress inherent with dorm life in jail. I never imagined how much more I would gain. I was on Rikers Island because of an addiction to drugs that I've had in varying degrees most of my adult life. The attraction to drugs was a natural outcome of my early years when I had no focus and little direction. I had dropped out of college after a year because I didn't know what I wanted to do with my life. After that, I sort of drifted into drugs. I often thought of returning to school, but could never decide on a course of study. Consequently, I did nothing.

After working in the gardens for a month or so, I started to realize that horticulture was an area that combined many of my interests – science, art and applied technical skills. In talking with my instructors, I began to realize that horticulture might be the perfect career choice for me. For the first time in my adult life I had a focus, an area of study which I wanted to pursue. I decided that after Rikers Island I would seek employment in the horticulture field. Wanting to change your life and actually doing it are two different things. I knew that I had to take things one step at a time, and that I would need help. My first step was to resolve my problems with substance abuse. I did this by going to an outpatient program for drug users.

My next step was to try to get some more experience in the horticulture field. There was only one thing I missed about Rikers Island: the time I spent working the greenhouse and gardens. When I learned about a local hospital that had a greenhouse, I volunteered to work there. One day a week I help with general greenhouse maintenance and waiting on customers.

I then moved on to find a paying job in the horticulture field. I'm happy to say that I am now employed as a horticulture team leader for an agency that serves former homeless persons with a history of mental illness. Horticulture is one of the areas the clients can choose for job training. I am responsible for two teams of clients that work in either Riverside Park or on the malls of upper Broadway and train and supervise them in soil preparation, planting, plant care and maintenance. I really enjoy my job, but I have a future goal. I plan to continue my education in the horticulture field. By winter, I plan to be enrolled as a student at the New York Botanical garden's School of Professional Horticulture. I've arranged financial assistance and my application is ready to be submitted this summer. All of this has come about from my experience in jail.