

## Sustainability September: Permaculture

Learn about permaculture gardens and what we have growing in the Duke Farms permaculture garden.

The word *permaculture* was derived from the term “permanent agriculture”. It is a form of sustainable agriculture that was started in the 1970s by Australian ecologist, Bill Mollison. The goals of permaculture include eliminating waste and pollution, avoiding damage to soil, increasing the crop yield, and mimicking natural ecological processes.

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*“Permaculture is a philosophy of working with, rather than against nature; of protracted and thoughtful observation rather than protracted and thoughtless labour; and of looking at plants and animals in all their functions, rather than treating any area as a single product system”.*

*–Bill Mollison*

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Permaculture gardens are often intricate and intriguing in their designs. Each element works together to create a functional design that has been carefully thought out and structured, while utilizing long-lasting natural materials throughout the garden. Patterns of and throughout permaculture gardens often mimic shapes found in nature and are pleasing to the eye.



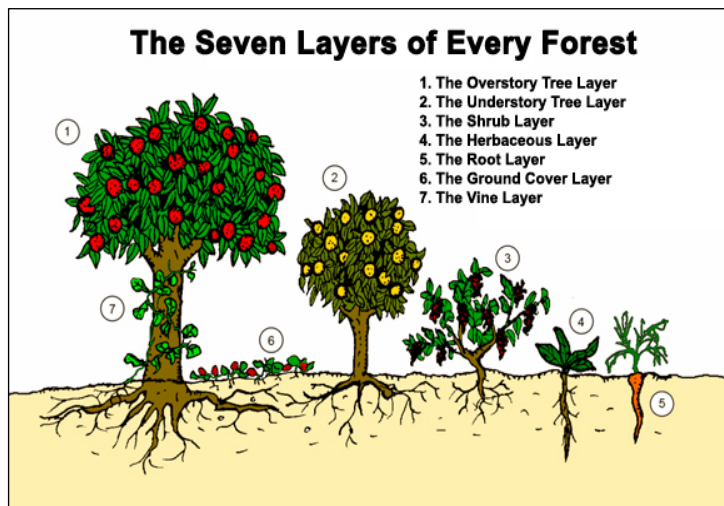
Beautiful backyard permaculture garden design. [Source](#).



Unique permaculture design. [Source](#).

*There are seven distinct layers to a permaculture garden:*

1. The canopy layer which consists of the tallest trees, including timber and nut trees.
2. The sub-canopy layer which is the second tallest layer consisting of fruit trees such as apple, peach, and fig.
3. The shrub layer, which is a shorter layer than the last. This layer contains shrubs and bushes including raspberries and blackberries.
4. The herbaceous layer, again, shorter than the last layer. This contains plants like asparagus, beans, and native perennial flowers.
5. The ground cover layer which is the second lowest layer, and these plants are things like strawberries, mint, and lemon balm.
6. The underground layer which is the lowest layer of plants. These are root vegetables such as carrots, potatoes, onions, and garlic. Fungi are also included in this layer.
7. The final **layer** is the vertical layer. This consists of runners or vines including hops, grapes, and running beans.



The 7 layers of a permaculture garden (above). [Source](#).



Permaculture zones (below). [Source](#).

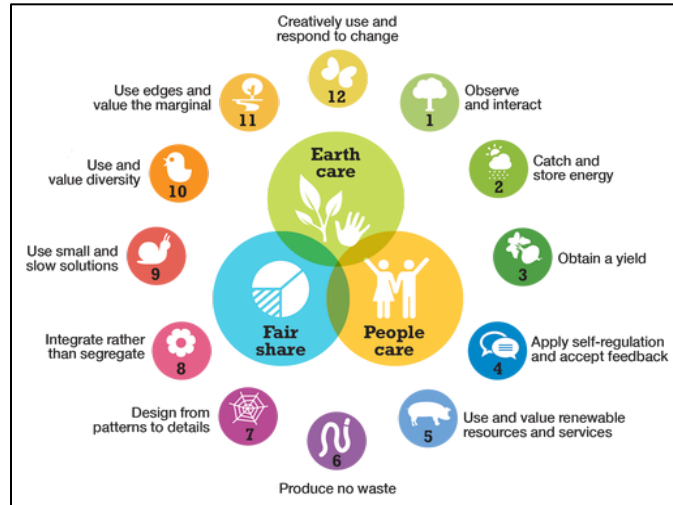
Permaculture gardens are also looked at as zones so they can be utilized as efficiently as possible.

- **Zone 0** is where your home is and where you spend most of your time.
- **Zone 1** is the closest to you allowing for easy access to things like herbs and annual produce used frequently in the kitchen.
- **Zone 2** is a little farther away and has but still has some overlap with zone 1. This zone can have native perennial plants, garden sheds or greenhouses, and small domesticated animals.
- **Zone 3** is where there starts to become more of a distinction between the areas. This will be an area that needs less maintenance than the zones we have discussed so far. This zone might be where rainwater is typically collected for use because it is going to be farther away from a water source by the home. It also still includes vegetable crops, grazing areas for animals, and more native perennials.
- **Zone 4** has even less maintenance needed than zone 3 and has things like fruit trees and hardwood trees
- **Zone 5** is the wild zone, farthest away from the home and needs no maintenance once established.

There is also a set of ethics and principles that go along with permaculture gardening.

- **Earth care** means to care for the Earth and all its inhabitants, living and non-living. Everything is interconnected, and we must focus on everything for survival and function.
- **People care** means to have the Earth's vital resources available to all humans.
- **Fair share** means being able to meet our own needs while returning excess materials back to the Earth and its people.

There are 12 principles that are followed while building and managing a permaculture garden. Observe the photo to the right. In the center you can find the ethics followed in permaculture gardening, and all around you can find the 12 principles. Each principle is connected to one or more of the ethics discussed.



The ethics and principles of permaculture. [Source](#).

Permaculture gardening has many benefits, some include:

1. Zero waste
2. Protection of the planet's resources
3. Using land efficiently
4. Low maintenance after established
5. Creating habitat to attract different species to your yard
6. Connecting you with nature and allowing for a healthier lifestyle

The permaculture garden at Duke Farms can be found in between the Farm Barn and the Community Garden. The initial planning process took about a year with modifications being made throughout the whole process. It was designed by the National Organic Farming Association (NOFA) along with a Rutgers landscape design course in the early 2010's. In the Duke Farms permaculture garden, you can find blueberry bushes, peach, apple, pear, cherry, and pawpaw trees, as well as herbs and native perennial wildflowers to attract pollinators. Produce and herbs from the garden are often used in the café on-site.



Jerusalem Artichoke



Paw Paw Fruit



Blueberry Bushes



### **Activity: Plan Your Permaculture Garden**

[Here](#) is an example of a separate plan for a permaculture garden at Duke Farms. Consider information from this article and the plan linked above (and do any other research you would like) to create your own plan for a permaculture garden and to draw a layout. It can be derived from a real place like your house or a family member's house or you can create a location where you would want your permaculture garden to be. Be as basic or in-depth as you would like.

Topics to consider discussing in your plan:

- Climate of the area
  - Average yearly temperature.
  - What plants grow in that climate.
- Layout
  - How large is your space?
  - List the crops, trees, and flowers you would have and where you would place them in your garden.
  - Would you have animals and where?
  - Where would your compost, water sources, sheds, etc. be located?
  - Draw a layout of your zones
- Grand scheme/thinking ahead
  - What would you do with your produce?
  - What wildlife would you want to attract?
  - In what ways would your garden be sustainable or what sustainable features will it have?
- Ethics and principles of permaculture gardening
  - Take time to reflect on the ethics and principles in your plan.
  - Which stood out to you most?
  - Are there any principles or ethics you think are missing? What other standards would you want to be included?
- Self-reflection
  - Does planning, building, and maintaining a permaculture garden sound like something you would enjoy doing in real life? Why or why not?
  - What do you like about this idea and what do you not like?

### **Extensions for Learners**

For learners of all ages, planning a garden on grid paper may be a great way to start. Just assigning a measurement to each box and knowing enough about how each plant grows and what it needs for space is a fairly sophisticated task. From there, the similarities and differences between different types of gardens and a permaculture garden could be introduced.



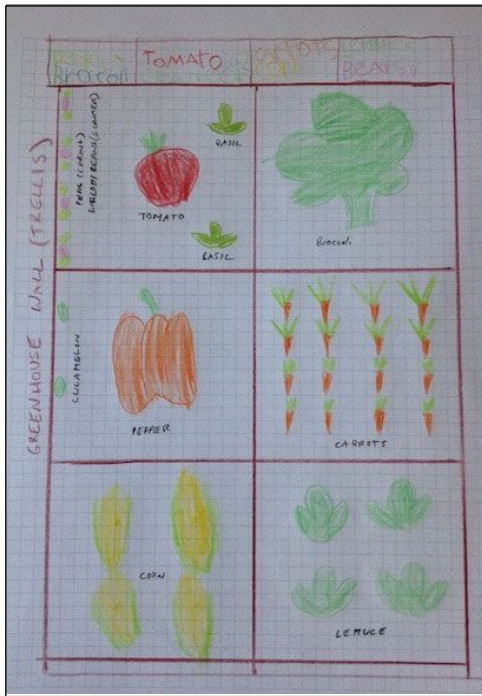


Photo source: Tranquil Urban Homestead

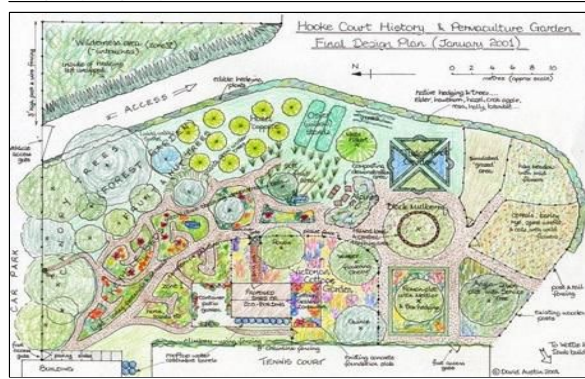
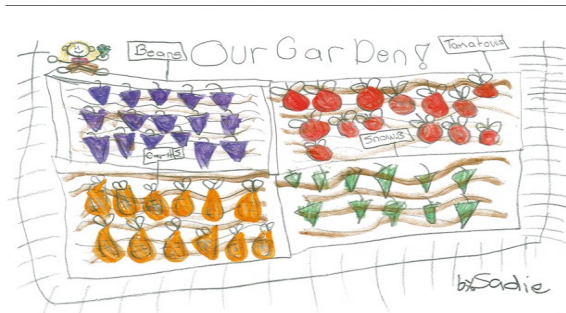
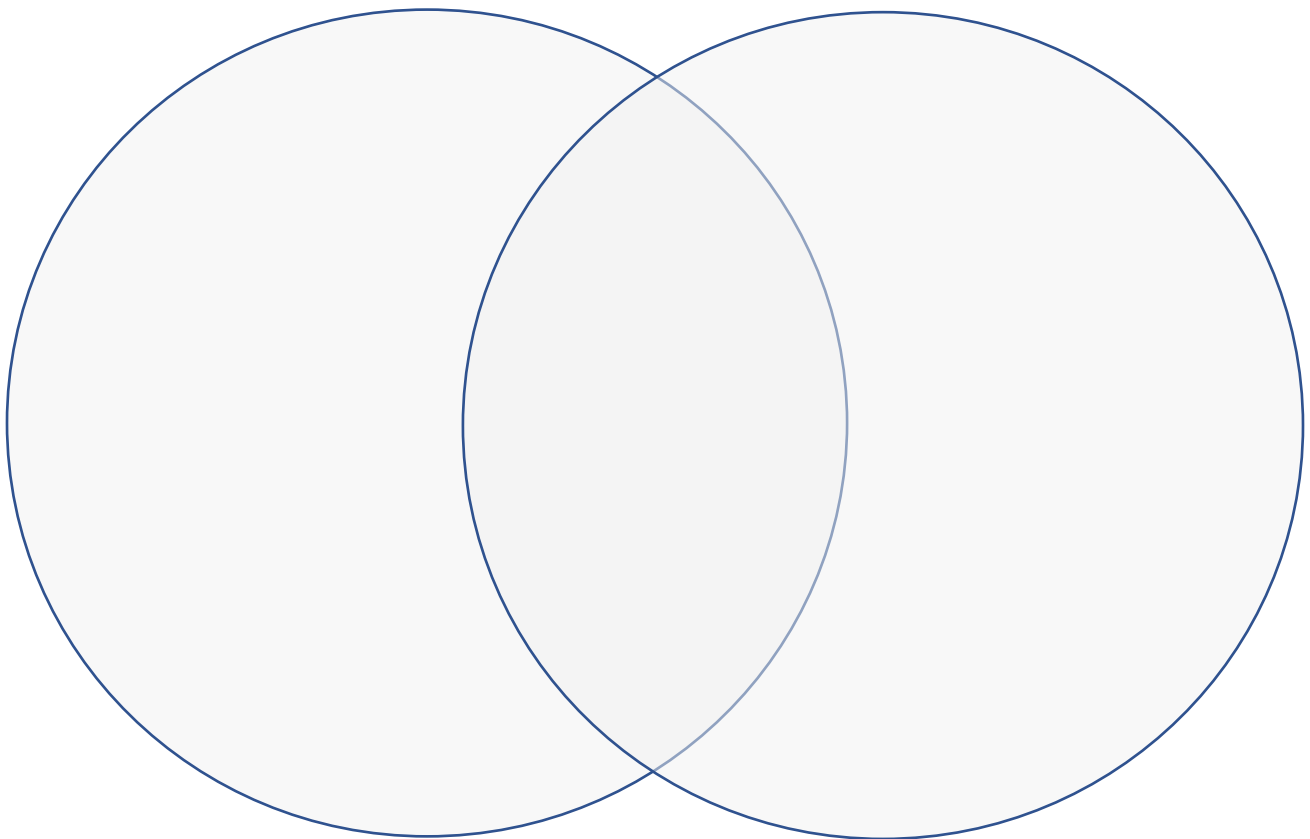


Photo source: [Knowledge base](#)

Learners can compare a permaculture garden to another type of garden using this Venn diagram.





## Climate Change

Permaculture Gardens are located around this country and others and many are open to the public for exploration. Students projects could include discovering where these gardens are located and what they have growing in them. They may also develop their own schematics to replicate these gardens and then create new renditions or modifications, explaining why these elements were selected and how they relate to climate change.

Consider contacting us for more information about our Permaculture Garden or for a virtual tour. Email Kate Reilly at [kreilly@dukefarms.org](mailto:kreilly@dukefarms.org)

**Learning about the Permaculture Gardens at Duke Farms aligns with the newly adopted NJ Student Learning Standards.** For more information about how you may use this topic in your PK-12 and beyond classrooms, contact Kate Reilly, Manager of Education, Duke Farms at [kreilly@dukefarms.org](mailto:kreilly@dukefarms.org)

## Adopted 2020 New Jersey Student Learning Standards (NJSLS)

### Climate Change

New Jersey is the first state in the country to require climate change curriculum across all content areas and at a K-12 level. As stated by the NJDOE:

On June 3, 2020, the State Board of Education adopted the 2020 NJSLS in the following content areas:

- Career Readiness, Life Literacies, and Key Skills;
- Comprehensive Health and Physical Education;
- Computer Science & Design Thinking;
- Science;
- Social Studies;
- Visual and Performing Arts;
- and World Languages.

These standards truly represent a foundation from which districts will build coherent curriculum and instruction that prepares each New Jersey student with the knowledge and skills to succeed in our rapidly changing world. They will put New Jersey again at the forefront of national education by including the following:

- Climate Change across all content areas, leveraging the passion students have shown for this critical issue and providing them opportunities to develop a deep understanding of the science behind the changes and to explore the solutions our world desperately needs.

### Mathematics Curriculum

Designing and plotting out a garden may also be a way to incorporate NJ Learning Standards in Mathematics. Examples such as:

- Grade 3 - Geometric measurement: understand concepts of area and relate area to multiplication and to addition. 5. Recognize area as an attribute of plane figures and understand



concepts of area measurement. a. A square with side length 1 unit, called “a unit square,” is said to have “one square unit” of area, and can be used to measure area. (*Using graph paper – create the garden, discuss units.*)

- Grade 4 - Apply the area and perimeter formulas for rectangles in real world and mathematical problems. For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor. (*Replace room with garden plot*)
- Grade 6 - Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (*Ratio of one type of plant to another in a garden*)
- HS Geometry - Solve real-life and mathematical problems involving angle measure, area, ....