Sun One Organic Farm Landform/Soil Data and Discussion

50 Maddox Road Bethlehem, CT 06751

Abstract: This document aims to put Sun One Organic Farm into a Permaculture perspective. This particular perspective is related to landform and soils on the property. The goal of the document is to provide deep information into the landforms occurring on the property and the parent material geology that gave rise to the soils that now cover the landscape. There will be a discussion on the end with aim to provide appropriate parameters for Permaculture design on the property.

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Types of Soils Found on the Property (Prime Farmland Soil or Farmland with Statewide importance) [1]:

1. Paxton and Montauk fine sandy loams 3-8% slopes (Prime Farmland Soil) [5.4 Acres] {84B} (Soils Class 2e) [11% Land Area]
2. Paxton and Montauk fine sandy loams 8-15% slopes (Farmland with Statewide Importance) [17.3 Acres] {84C} (Soils Class 3e) [31% Land Area]
3. Sutton fine sandy loam 0-3% slopes (Farmland with Statewide Importance) [1.9 Acres] {50A} (Soils Class 2w) [4% Land Area]
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Types of Soils Found on the Property (Non-Prime Farmland Soil) [1]:

1. Woodbridge fine sandy loam 2-15% slopes (Extremely Stony) [14.2 Acres] {47C} (Soils Class 7s) [27% Land Area]
2. Canton and Charlton soils 15-25% slopes (Extremely Stony) [2.5 Acres] {62D} (Soils Class 7s) [5% Land Area]
3. Charlton-Chatfield Complex 3-15% slopes (Very Rocky) [1 Acre] {73C} (Soils Class 6s) [2% Land Area]
4. Paxton and Montauk soils 15-25% slopes [4.3 Acres] {84D} (Soils Class 4e) [8% Land Area]

Landforms

'A natural feature (such as mountain or valley) of the Earth's surface.' [2]

It is important to look at the landform in order to provide appropriate context for the Permaculture design method. The current landforms that are observed at 50 Maddox Road Bethlehem, CT are derived from the Quarternary glaciation, also known as the Pleistoscene glaciation. Due to this glaciation, all landforms are in one way or another created by the movement and existence of glaciers.

Types of Landforms found on Sun One Organic Farm:

Depressions (50A)

Drainageways (50A)

Drumlins (84B, 84C, 84D, 47C, 45C)

Floodplains (101)

Hills (60B, 62D, 73C, 84B, 84C, 84D, 47C, 45C)

Till-plains (84B, 84C, 84D)

Descriptions of the Landforms [3]:

Depression – Any relatively sunken part of the Earth's surface; especially a low-lying area surrounded by higher ground. A closed depression has no natural outlet for surface drainage (e.g., a sinkhole). An open depression has a natural outlet for surface drainage. Compare – closed depression, open depression. GG

Drainageway – (a) A general term for a course or channel along which water moves in draining an area. GG. (b) [soil survey] a term restricted to relatively small, roughly linear or arcuate depressions that move concentrated water at some time, and either lack a defined channel (e.g., head slope, swale) or have a small, defined channel (e.g., low order streams). SW

Drumlin – A low, smooth, elongated oval hill, mound, or ridge of compact till that has a core of bedrock or drift. It usually has a blunt nose facing the direction from which the ice approached and a gentler slope tapering in the other direction. The longest axis is parallel to the general direction of glacier flow. Drumlins are products of streamline (laminar) flow of glaciers, which molded the subglacial floor through a combination of erosion and deposition. Compare – drumlinoid ridge. SW, HP, & GG

Floodplain – The nearly level plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the streams. HP

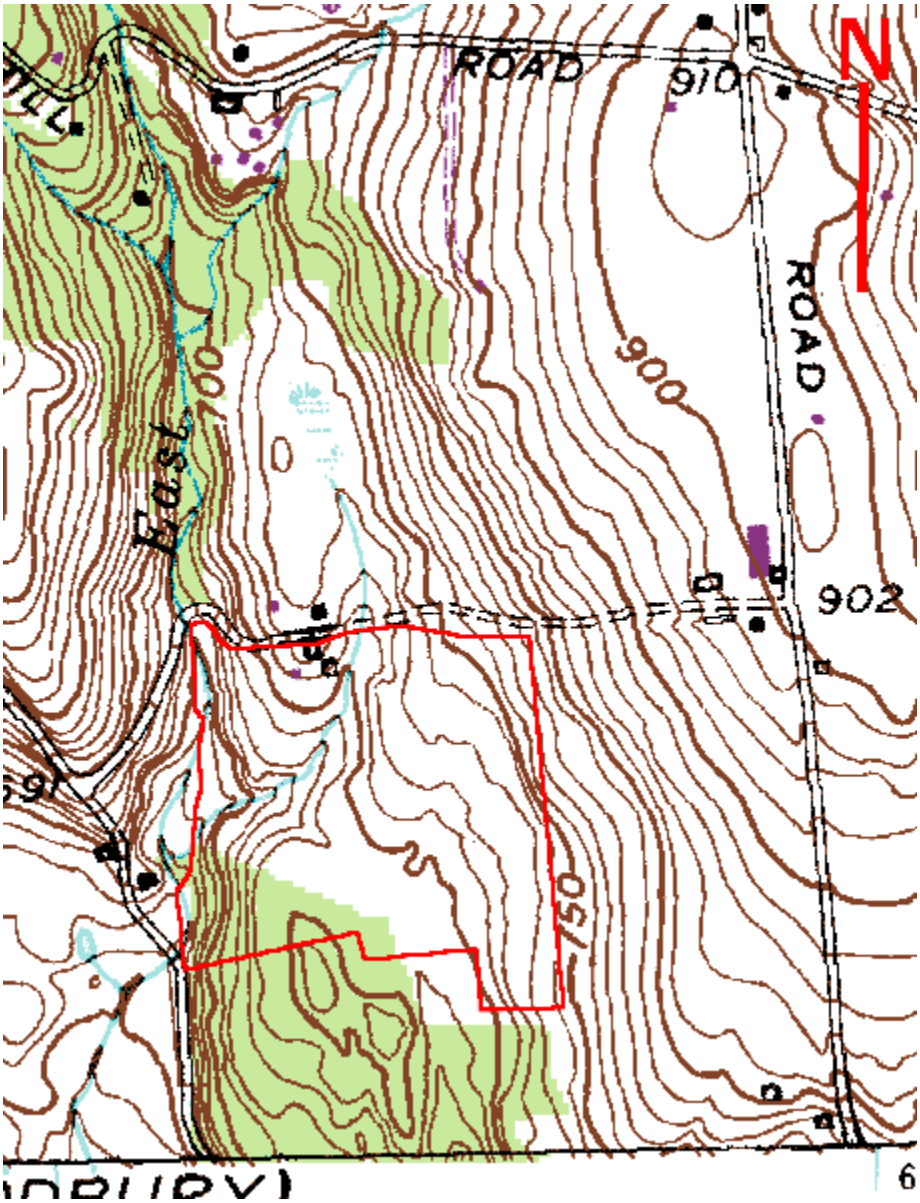
Hill – A generic term for an elevated area of the land surface, rising at least 30 m (100 ft.) to as much as 300 meters (approx. 1000 ft.) above surrounding lowlands, usually with a nominal summit area relative to bounding slopes, a well-defined, rounded outline and slopes that generally exceed 15 percent. A hill can occur as a single, isolated mass or in a group. A hill can be further specified based on the magnitude of local relief: *low hill* (30 – 90 m) or *high hill* (90 - 300 m). Informal distinctions between a hill and a mountain are often arbitrary and dependent on local convention. Compare – hillock, plateau, mountain, foothills, hills. SW & HP

Till-plain – An extensive, flat to gently undulating area underlain predominantly by till and bounded on the distal end by subordinate recessional or end moraines. Compare – till, ground moraine. SW

- Till – [glacial] Dominantly unsorted and unstratified drift, generally unconsolidated and deposited directly by a glacier without subsequent reworking by meltwater, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders; rock fragments of various lithologies are imbedded within a finer matrix that can range from clay to sandy loam. Compare – supraglacial till, subglacial till, flow till, lodgment till, melt-out till, drift, moraine. SW & GG
- Ground Moraine – (a) Commonly an extensive, low relief area of till, having an uneven or undulating surface, and commonly bounded on the distal end by a recessional or end moraine. (b) A layer of poorly sorted rock and mineral debris (till) dragged along, in, on, or beneath a glacier and deposited by processes including basal lodgment and release from downwasting stagnant ice by ablation. Compare – end moraine, recessional, moraine, terminal moraine. SW

Topographical Position [4]

Sun One is located mid-slope topographically.



Bedrock Geology [5][6][7][8][9][10]

Definition – "The term describes the study of the rocks at and below the bedrock surface."[5]

The bedrock geology at Sun One is interestingly split between two different types of materials. The two different bedrock geologies present on the property are *Ratlum Mountain*

Schist (Original Map Symbol 'Or') and *Nonewaug Granite (Original Map Symbol 'Dng')*. [6]
Refer to the appendix for glossary of relevant geology.

Ratlum Mountain Schist [7] –

- Primary Rock Type – Schist
- Secondary Rock Type – Granofels
- Other Rock Types – Amphibolite, Calc-silicate rock

Logilithic Constituents:

Major-

- Metamorphic>Schist – Gray, Medium-grained, interlayer schist and granofels, composed of quartz, oligoclase, muscovite (in the schist), biotite, and garnet, also staurolite and kyanite in the schist.
- Metamorphic>Granoblastic>Granofels – Gray, Medium-grained interlayered schist and granofels, composed of quartz, oligoclase, biotite, and garnet.

Minor-

- Metamorphic>Amphibolite – Incidental.
- Metamorphic>Metasedimentary>Calc-silicate rock – Some of quartz-spessartine (coticule) and calc-silicate rock.

Qualities:

- **Permeability** - Glacial till is considered compact, essentially structureless, and homogenous, very poorly sorted (consisting of rock fragments ranging from clay to boulder sized), and is quite impervious to groundwater flow. (King's Mark 2001:43)
- **Depth** – I could not find any data that could tell me the depth of bedrock geology. This data may or may not be available.
- **Nutrient Content**[10]–
  - Granofels –
    - Quartz – SiO_2
    - Oligoclase - $(Na,Ca)[(Si,Al)AlSi_2O_8]$
    - Biotite - $K_2Mg_6(Si_6Al_2O_{20})(OH,F)_2$ mica group, with Fe^{2+} replacing Mg and Fe^{3+} replacing Al
    - Garnet - $A_3B_2(SiO_4)_{3-2Dx}(OH)_{4x}$ in which A=(Ca,Fe,Mg,Mn) and B=(Al,Cr,Fe,Mn,Si,Ti,V,Zr) with Si partly replaced by (Al,Fe).

- Schist –
  - Quartz - SiO_2
  - Oligoclase - $(Na,Ca)[(Si,Al)AlSi_2O_8]$
  - Muscovite - $KAl_2(Si_3Al)O_{10}(OH,F)_2$
  - Biotite - $K_2Mg_6(Si_6Al_2O_{20})(OH,F)_2$
  - Garnet - $A_3B_2(SiO_4)_{3-2Dx}(OH)_{4x}$
    in which A=(Ca,Fe,Mg,Mn)
    and B=(Al,Cr,Fe,Mn,Si,Ti,V,Zr)
    with Si partly replaced by (Al,Fe).
  - Staurolite - $Fe_2Al_9Si_4O_{22}(OH)_2$
  - Kyanite - $4[Al_2SiO_5]$
- Other
  - Amphibolite
    - Amphibole - $A_{0-1}B_2Y_5Z_8O_{22}(OH,F,Cl)$
      where (A=Ca,Na,K,Pb,B),
      (B=Ca,Fe,Li,Mg,Mn,Na),
      (Y=Al,Cr,Fe,Mg,Mn,Ti),
      and (Z=Al,Be,Si,Ti)
    - Plagioclase - $(Na,Ca)Al(Si,Al)Si_2O_6$
  - Quartz-Spessartine - SiO_2 - $Mn_3Al_2(SiO_4)_3$
  - Calc-Silicate
    - Diopside - $CaMgSi_2O_6$
    - Wallastonite - $CaSiO_3$

- **Acidity (Silica Content)** – Acidity is actually an incorrect term to be using in geology; acid rock is typically used as a synonym for high silica containing rock. Therefore there is not so much acidity to be recognized in the bedrock geology but the content of silica. The schist is comprised predominately of silicate type rock, making schist more or less felsic (acidic). The granofels are also predominately made of silicate type rock, making the granofels more or less felsic (acidic) Amphibolite is derived mainly from amphibole and plagioclase feldspar, which are typically dark and mafic in origin which is basic. Quartz-Spessartine and Calc-Silicate are obviously comprised of an amount of Silica such that silicate materials are represented in the name and therefore are more felsic. Based on the comprising materials, I would have to conclude that Ratlum Mountain Schist is more Felsic than Mafic. (Acidic)

Nonnewaug Granite[8] –

- Primary Rock Type – Granite
- Secondary Rock Type – Pegmatite

Logilithic Constituents:

Major-

- Igneous>Plutonic>Granitic>Granite – White to pink, fine-to very coarse-grained (commonly migmatitic), massive to layered granite composed of albite, microcline, quartz, and muscovite, with minor biotite, and garnet. Microcline commonly graphic; quartz and muscovite commonly in plumose aggregates.
- Igneous>Plutonic>Granitic>Leucocratic-granitic>Pegmatite – (commonly pegmatitic)
  Qualities:
  - **Permeability** – Glacial till is considered compact, essentially structureless, and homogenous, very poorly sorted (consisting of rock fragments ranging from clay to boulder sized), and is quite impervious to groundwater flow. (King's Mark 2001:43)
  - **Depth** – I could not find any data that could tell me the depth of bedrock geology. This data may or may not be available.
  - **Nutrient Content [9]**–
    - Pegmatite – Generally of granite. May include Li, B, F, Nb, Ta, U, and possibly Rare Earth Metals.
    - Granite
      - Albite – $NaAlSi_3O_8$
      - Microcline - $KAlSi_3O_8$
      - Quartz - SiO_2
      - Muscovite - $KAl_2(Si_3Al)O_{10}(OH,F)_2$
      - Biotite - $K_2Mg_6(Si_6Al_2O_{20})(OH,F)_2$
      - Garnet - $A_3B_2(SiO_4)_{3-2Dx}(OH)_{4x}$
        in which A=(Ca,Fe,Mg,Mn)
        and B=(Al,Cr,Fe,Mn,Si,Ti,V,Zr)
        with Si partly replaced by (Al,Fe).
  - **Acidity (Silica Content)** – Acidity is actually an incorrect term to be using in geology; acid rock is typically used as a synonym for high silica containing rock. Therefore there is not so much acidity to be recognized in the bedrock geology but the content of silica. Both of the rocks that make up Nonnewaug Granite are granitic types of rock and therefore have a very high percentage of silica, making them essentially more 'acidic' but in correct terms they are 'Felsic'.

Surficial Geology [10][12]

Definition – "Surficial Geology refers to the study of landforms and the unconsolidated sediments that lie beneath them. The majority of the unconsolidated sediments found at the land surface were deposited during the late Wisconsin glaciation 21,000 to 13,600 years ago." [10]

The surficial geology at Sun One is comprised of three different types of material. These types are Alluvium (Qal), Ice-Contact Stratified Drift (Qcd), and Till (Qt). [11]

- Alluvium (Qal) – Chiefly poorly sorted silt, sand, and gravel in areas subject to flooding by streams…Chiefly of Holocene age, but in valley of Still Brook and a few other places probably includes much stratified drift of late Pleistocene age.
- Ice-Contact Stratified Drift (Qcd) – Sand and gravel deposited adjacent to ice by glacial melt water; commonly contains cobbles and a few scattered boulders…Shallow swales are present in places, but no steep-sided kettles. Generally antedates adjacent bodies of outwash, but in part probably contemporary with outwash deposits elsewhere in the quadrangle.
- Till (Qt) – Unsorted mixture of sand with silt, clay, rock flour, and angular to rounded stones, including boulders that are commonly 6-10 feet and in places as much as 30 feet in maximum diameter. Pockets or lenses of sand and gravel present in places. Generally compact and blocky below the top 3 or 4 feet, and believed to be chiefly lodgement till, deposited from the base of actively moving ice.

Soil Properties (Due to Surficial Geology) [12][13]

There are plenty of different soil types that form from landform and surficial geology. This section details permeability, depth (to bedrock), stoniness, nutrient content, acidity, and suitability for various uses of the surficial geology.

Primer on Parent Material

Parent Material consists of melt out till, lodgement till and alluvial floodplain materials.

- Melt-out Till - Melt-out till is material deposited, as the ice beneath the glacier slowly melts away. It is less consolidated and friable than lodgement till.
- Lodgement Till - Lodgement Till is material deposited directly beneath the glacier under enormous pressure. It is compact and contains a greater amount of fine-grained sediment. The compact or dense layer reduces the flow of air and water movement, producing a slowly permeable zone which supports perched water tables.
- Alluvial Floodplain - Alluvial or floodplain deposits are transported by streams overflowing their bank.

{84B}{84C}{84D}{86D}– 55% Paxton, 30% Montauk in area. 15% Other. [12][13]

- Parent Material – *coarse-loamy lodgment till (Both)*
- Permeability - Well drained. (Both)
- Estimated Depth to Bedrock, Hardpan, or Impermeable Layers of Soil - Depth to bedrock is commonly more than 1.5 meters. The soils are very deep to bedrock Thickness of the solum and depth to the dense substratum typically ranges from 50 to 97 cm, but the range currently includes 45 to 97 cm.
- Stoniness – Except where the surface is stony, the fragments are mostly subrounded gravel and typically make up 60 percent or more of the total rock fragments. Some areas have very stony or extremely stony surfaces.
- Nutrient Content – Refer to Soil Test.
- Acidity – Unless limed, reaction ranges from very strongly acid through moderately acid in the mineral soil. The soil ranges from extremely acid to moderately acid.
    - Paxton – Soil Horizon
        - Ap - strongly acid
        - Bw1 - strongly acid
        - Bw2 - strongly acid
        - Cd - strongly acid
    - Montauk – Soil Horizon
        - A – strongly acid
        - Bw1 – strongly acid
        - Bw2 – strongly acid
        - 2Cd1 – strongly acid
        - 3Cd2 – strongly acid
- Suitability for various uses –Many areas are cleared and used for cultivated crops, hay, or pasture. Scattered areas are used for community development. Some areas are wooded. Common trees are red, white, and black oak, hickory, sugar maple, red maple, gray and black birch, eastern white pine, and eastern hemlock. Many of the nearly level and gently sloping areas are cleared and used for production of potatoes and vegetable crops, hay, silage corn and pasture. Steeper and uneven areas are largely forested. Woodland contains northern red oak, white oak, and occasionally yellow poplar, eastern white pine, red pine, sugar maple, beech, and birch.
- Estimated Seasonal High Water Table Depth – Greater than 6 feet in depth. (Both)
- Runoff Potential - Surface runoff is negligible to high. Runoff is low to high.
- Landslide Potential – Low (Both)

{47C}{45C}{45B} Woodbridge 80% in area. 20% Other. [14]

- Type of Parent Material - *coarse-loamy lodgment till*
- Permeability - Moderately well drained.
- Depth - very deep to bedrock and moderately deep to a densic contact.
- Stoniness - Except where the surface is stony, the fragments are mostly subrounded gravel and typically make up 60 percent or more of the total rock fragments.
- Nutrient Content – N/A
- Acidity - Unless limed, reaction ranges from very strongly acid through slightly acid.
- Suitability for Various Uses - Many areas are cleared and used for cultivated crops, hay, or pasture. Scattered areas are used for community development. Some areas are wooded. Common trees are red, white, and black oak, hickory, white ash, sugar maple, red maple, eastern hemlock, and eastern white pine.
- Estimated Seasonal High Water Table Depth – 24 to 40 inches
- Estimated Depth to Bedrock, Hardpan, or Impermeable Layers of Soil - Depth to bedrock is commonly more than 2 meters.
- Runoff Potential - The potential for surface runoff is moderate to very high.
- Landslide Potential - Low

{50A} Sutton 80% Area. 20% Other. [15]

- Type of Parent Material – coarse-loamy melt-out till
- Permeability – Moderately Well Drained
- Depth - very deep
- Stoniness - Except where the surface is stony, the fragments are mostly subrounded gravel and typically make up 60 percent or more of the total rock fragments.
- Nutrient Content – N/A
- Acidity - Unless limed, reaction ranges from very strongly acid to moderately acid.
- Suitability for Various Uses - Cleared areas are used for cultivated crops, hay, or pasture. Scattered areas are used for community development. Some areas are wooded. Common trees are red oak, white oak, black oak, hickory, ash, red maple, gray birch, hemlock, and white pine.
- Estimated Seasonal High Water Table Depth – 24-40 inches
- Estimated Depth to Bedrock, Hardpan, or Impermeable Layers of Soil - Depth to bedrock is commonly more than 2 meters.
- Runoff Potential - Surface runoff is slow to medium.
- Landslide Potential – Low

{60B}{62D Extremely Stony} Canton 45%, Charlton 35% of area. Other is 20%. [16][17]

Type of Parent Material - *coarse-loamy over sandy and gravelly melt-out till* *coarse-loamy melt-out till*

- Permeability – well drained (both)
- Depth - very deep (both)
- Stoniness - extremely bouldery in a forested area Except where the surface layer is stony, the fragments are mostly subrounded gravel and typically make up 60 percent or more of the total rock fragments.
- Nutrient Content – N/A
- Acidity - The soil ranges from extremely acid through moderately acid. Unless limed, reaction ranges from very strongly acid to moderately acid.
- Suitability for Various Uses - Mostly forested. Some areas have been cleared of surface stones and are used for crops and pasture. Native vegetation is forest composed of eastern white pine, northern red, white, and black oaks, hickory, red maple, sugar maple, gray birch, yellow birch, beech, eastern hemlock, and white ash. Areas cleared of stones are used for cultivated crops, specialty crops, hay, and pasture. Many scattered areas are used for community development. Stony areas are mostly wooded. Common trees are northern red, white, and black oak, hickory, sugar maple, red maple, black and gray birch, white ash, beech, white pine, and hemlock.
- Estimated Seasonal High Water Table Depth – greater than 6 feet
- Estimated Depth to Bedrock, Hardpan, or Impermeable Layers of Soil - Depth to bedrock is commonly more than 180 centimeters.
- Runoff Potential - Runoff is negligible to medium. (Both)
- Landslide Potential - Low

{101} Occum 80% of area. Other is 20%. [18]

- Type of Parent Material – coarse-loamy alluvium
- Permeability – well drained
- Depth – very deep
- Stoniness - Gravel ranges from 0 to 15 percent by volume in the solum and from 0 to 60 percent in the substratum. Some pedons have up to 10 percent cobbles in the substratum
- Nutrient Content – N/A
- Acidity - Unless limed, reaction ranges from very strongly acid to slightly acid.

- Suitability for Various Uses - Cleared areas are used for cultivated crops, hay, and pasture. Common trees in wooded areas are sycamore, white pine, white, yellow, and gray birch, red maple, sugar maple, hemlock, and red and white oak.
- Estimated Seasonal High Water Table Depth – greater than 6 feet
- Estimated Depth to Bedrock, Hardpan, or Impermeable Layers of Soil
- Runoff Potential - Surface runoff is negligible to low.
- Landslide Potential - Low

{73C}Charlton 45%, Chatfield 30% [17][19]

- Type of Parent Material - *coarse-loamy melt-out till*
- Permeability – well drained well drained and somewhat excessively drained
- Depth - They are moderately deep to bedrock.
- Stoniness - Except where the surface layer is stony, the fragments are mostly subrounded gravel and typically make up 60 percent or more of the total rock fragments. Rock outcrops are rare or common and are limited to the more resistant bedrock.
- Nutrient Content – N/A
- Acidity - Unless limed, reaction ranges from very strongly acid to moderately acid.
- Suitability for Various Uses - Areas cleared of stones are used for cultivated crops, specialty crops, hay, and pasture. Many scattered areas are used for community development. Stony areas are mostly wooded. Common trees are northern red, white, and black oak, hickory, sugar maple, red maple, black and gray birch, white ash, beech, white pine, and hemlock. Most areas of Chatfield soils are in woodland. Major tree species include white and northern red oaks, sugar maple, beech, eastern hemlock, eastern white pine, eastern red cedar, and shagbark hickory. Some small cleared areas are used for pasture, are idle, or are sites for residential and recreational development.
- Estimated Seasonal High Water Table Depth – greater than 6 feet generally below 6 feet
- Estimated Depth to Bedrock, Hardpan, or Impermeable Layers of Soil - Depth to bedrock is commonly more than 180 centimeters. Depth to bedrock ranges from 20 through 40 inches (50 through 100 centimeters)

- Runoff Potential - Runoff is negligible to medium. Potential for surface runoff ranges from low to high.
- Landslide Potential - Low

{34B} Merrimac 80% [20]

- Type of Parent Material - *sandy and gravelly glaciofluvial deposits*
- Permeability – somewhat excessively drained
- Depth – very deep
- Stoniness - The upper part of the solum commonly has 2 through 20 percent gravel, but includes cobbles in some pedons, and the lower part 5 through 30 percent. The substratum contains 2 through 55 percent gravel and 5 through 15 percent cobbles. Total volume of rock fragments in the particle-size control section is less than 35 percent.
- Nutrient Content – N/A
- Acidity - Reaction ranges from extremely acid through moderately acid, unless limed.
- Suitability for Various Uses - Most areas are cultivated and used for growing hay, pasture, silage, corn, or truck crops. Some areas are used to grow tobacco in the Connecticut River Valley in Massachusetts and Connecticut. Some areas are forested with mostly white pine, gray birch, hemlock, red maple, and red, black, white, and scarlet oaks.
- Estimated Seasonal High Water Table Depth – generally below 6 feet
- Estimated Depth to Bedrock, Hardpan, or Impermeable Layers of Soil -
- Runoff Potential - Runoff is negligible through medium.
- Landslide Potential - Low

Elevation

The elevation ranges from 620-840ft.

Relevance to Permaculture Design Plans

The landforms provide a macro perspective on the land. The knowledge of landform is mostly an exercise in education for further mastery of geology and parent soils. The property has been affected by glaciers in the past and cannot be altered easily by designers. Times where earthworks related to Permaculture would be appropriate would be building site excavation, roads, dams, graded banks or levees, swales, leaky micro-dams. [21] Vegetation on these landforms must also be closely paid attention to as they will indicate which plants should be introduced. For example, in soil (101), the floodplain, there will undoubtedly be plants that are going to be selected specifically for their tolerance in that area and economic utility. Also, if different aspects of the drumlin are to support certain microclimates and plant communities, this should be noted and designed for. Landform ultimately must be looked at from different use

perspective for installments because water is directly affected and thus the rest of the scale of permanence.

Discussion

Sun One is relatively free of need for major earthworks. If anything, access will be the most likely reason for earthworks. Roads will have to be created in the long run in order to effectively harvest and move materials that are grown on the property. Also there are about three places that water is flowing throughout the property; these are areas where other earthworks may be utilized in order to create more water catchment areas. Leveling for buildings is not an issue on most of the property because of the conservation easement. Therefore, leveling will only occur on the areas where there are development rights and will not be considered on the lion's share of the property. There is also the possibility of land grading in order to improve drainage or the properties of the soil. However I am not sure that it would be wise to embark on such a disturbance regime in order to 'improve' properties of the soil on this site. I would not suggest that any land grading occur and instead design for other types of crops and management in those areas that are steeper slopes. Terracing is also a possibility but annual crops are not the most important thing we need to be growing here, perennials are much more important and the grade it not so insane that terracing will be needed for that.

Conclusion

The most appropriate human originated landforms will be those related to access (roads), water catchment (dams, keyline, ponds) and those related to swales. Specific areas will be explored further in *site analysis* reports.

Appendix

Geology Glossary **[A1][A2][A3]**:

- Albite -a. A triclinic mineral, $NaAlSi_3O_8$; feldspar group, with up to 10 mol % CaAl replacing NaSi; a member of the plagioclase and the alkali feldspar series; prismatic cleavage; a common rock-forming mineral in granite, intermediate to felsic igneous rocks, low-temperature metamorphic rocks, and hydrothermal cavities and veins; can be used as a glaze in ceramics. [A3]

- Amphibole – A family of silicate minerals forming prism or needlelike crystals. Amphibole minerals generally contain iron, magnesium, calcium and aluminum in varying amounts, along with water.[A2][P1]

- Amphibolite – A rock made up mostly of amphibole and plagioclase feldspar. Although the name amphibolites usually refers to a type of metamorphic rock, an igneous rock composed dominantly of amphibole can be called an amphibolites too.[A2]
- Biotite – A common rock-forming mineral of the mica family. Biotite is a black or dark brown silicate rich in iron, magnesium, potassium, aluminum, and, of course, silica. Like other micas, it forms flat book-like crystals that peal apart into individual sheets on cleavage planes.[A2]
- Calc-silicate rock – A metamorphic rock consisting mainly of calcium-bearing silicates, such as diopside and wollastonite, and formed by metamorphism of impure limestone or dolomite. [A3]
- Diopside – A monoclinic mineral, $CaMgSi_2O_6$; pyroxene group; white to light green; in metamorphic rocks, esp. contact metamorphosed limestones. [A3]
- Garnet – Family of silicate minerals containing varying amounts of aluminum, iron, magnesium, and calcium. Schist and gneiss often has tiny, glassy red garnet dodecahedrons.[A2]
- Granite - Light colored, coarse grained, intrusive igneous rock characterized by the minerals orthoclase and quartz with lesser amounts of plagioclase feldspar and iron-magnesium minerals. Underlies large sections of the continents.[A1]
- Granitic – A general term for intrusive igneous rocks that look similar to granite but may range in composition from quartz-diorite to granite. All granitic rocks are light colored. [A2]
- Granoblastic – Pertaining to a homeoblastic type of texture in a nonschistose metamorphic tock upon which recrystallization formed essentially equidimensional crystals with normal well sutured boundaries. [A3]
- Granofels - A field name for a medium- to coarse-grained granoblastic metamorphic rock with little or no foliation or lineation. [A3]
- Igneous Rock – Rock formed when molten rock (magma) that has cooled and solidified (crystallized). [A2]
- Kyanite – An aluminum-rich, blue to light gren silicate mineral. Kyanite forms in metamorphic rocks at moderate temperature and high pressure. [A2]
- Leucocratic - Light-colored; applied to igneous rocks that are relatively poor in mafic minerals. The percentage of mafic minerals necessary for a rock to be classified as leucocratic varies among petrologists, but is usually given as less than 30% to 37.5%. [A3]
- Metamorphic Rock - A rock changed from its original form and/or composition by heat, pressure, or chemically active fluids, or some combination of them.[A1]

- Mica – Group of silicate materials composed of varying amounts of aluminum, potassium, magnesium, iron and water. All micas form flat, plate-like crystals. Crystals cleave into smooth flakes.[A2]
- Microcline - A triclinic mineral, $KAlSi_3O_8$; feldspar group; pseudomonoclinic; dimorphous with orthoclase; a major rock-forming mineral in granites, pegmatites, and metamorphic rocks; may be a detrital mineral in arkoses and graywackes. [A3]
- Migmatite - A composite rock composed of igneous or igneous-appearing and/or metamorphic materials that are generally distinguishable megascopically. [A3]
- Muscovite – One of the Mica family of minerals. Muscovite is light-colored or clear mica, sometimes called isingglass. [A2]
- Oglioclase - A triclinic mineral, $(Na,Ca)[(Si,Al)AlSi_2O_8]$; plagioclase series of the feldspar group; has NaSi (albite) 10 to 30 mol % and CaAl (anorthite) 90 to 70 mol %; pseudomonoclinic with prismatic cleavage and characteristic polysynthetic twinning commonly visible on cleavage traces; white; may be chatoyant; a common rock-forming mineral in igneous and metamorphic rocks of intermediate to high silica content; forms the entire mass in some anorthosites; less commonly a vein mineral. [A3]
- Pegmatite – A very coarse-grained igneous rock, commonly with a granitic composition. Usually forms from molten rock rich in water or other volatiles that facilitate the growth of large crystals. Forms sills and dikes. [A2]
- Plagioclase feldspar – A member of the fledspar mineral family. Plagioclase feldspars are silicates that contain considerable sodium and calcium. Felsdpar crystals are stubby prisms, generally white to gray and a glassy luster.[A2][P1]
- Plumose aggregates – Collections of rocks with a feathery appearance. [A3]
- Plutonic Rock – Any igneous rock that cools beneath the surface. [A2]
- Quartz – One of the most common minerals in the Earth's crust. Made up of silicon dioxide (SiO_2), it is also called silica. Commonly found in white masses. Crystals are clear, glassy 6-sided prisms. [A2][P1]
- Schist - A strongly foliated, coarsely crystalline metamorphic rock, produced during regional metamorphism, that can readily be split into slabs or flakes because more than 50% of its mineral grains are parallel to each other.[A1]
- Spessartine - An isometric mineral, $Mn_3\ Al2\ (SiO_4)_3$; garnet group with Mn replaced by Fe and Mg; crystallizes as dodecahedra and trapezohedra; in skarns and granite pegmatites; may be of gem quality. Also spelled spessartite. [A3]
- Staurolite - A monoclinic mineral, $Fe_2\ Al_9\ Si_4\ O_{22}\ (OH)_2$; pseudo-orthorhombic; Mohs hardness, 7.5; a common accessory in medium-grade regional metamorphic rocks; may be of gem quality; cruciform twins called fairy crosses. [A3]

[1]Soil Information is derived from reports found at Sun One…look for these.

[2] http://www.merriam-webster.com/dictionary/landform

[3]NCRS Glossary of Landform and Geologic Terms

[4] http://nationalmap.gov/ustopo/

[5] http://igs.indiana.edu/Bedrock/

[6] http://magic.lib.uconn.edu/connecticut_data.html#environmental (Bedrock Geology Line Map) (Polygon Map)

[7] http://mrdata.usgs.gov/geology/state/sgmc-unit.php?unit=CTOr%3B0 (Ratlum Mountain Schist)

[8] http://mrdata.usgs.gov/geology/state/sgmc-unit.php?unit=CTDng;0 (Nonewaug Granite)

[9] *Dictionary of Mining, Mineral, and Related Terms*. 2nd ed. Washington, D.C.?: U.S. Dept. of the Interior, 1996. Print.

[10] http://igs.indiana.edu/Surficial/

[11]USGS_GQ-848_1.pdf

[12]https://soilseries.sc.egov.usda.gov/OSD_Docs/P/PAXTON.html (Official Soil Series Paxton)

[13]http://casoilresource.lawr.ucdavis.edu/OSD_mirror/M/MONTAUK.html (Official Soil Series Montauk)

[14] https://soilseries.sc.egov.usda.gov/OSD_Docs/W/WOODBRIDGE.html

[15] https://soilseries.sc.egov.usda.gov/OSD_Docs/S/SUTTON.html

[16] https://soilseries.sc.egov.usda.gov/OSD_Docs/C/CANTON.html

[17] https://soilseries.sc.egov.usda.gov/OSD_Docs/C/CHARLTON.html

[18] https://soilseries.sc.egov.usda.gov/OSD_Docs/O/OCCUM.html

[19] https://soilseries.sc.egov.usda.gov/OSD_Docs/C/CHATFIELD.html

[20] https://soilseries.sc.egov.usda.gov/OSD_Docs/M/MERRIMAC.html

[21] http://www.small-farm-permaculture-and-sustainable-living.com/small_farm_earthworks.html

http://nesoil.com/properties/eshwt.htm (Seasonal High Water Table Information)

[] ngmdb.usgs.gov/Prodesc/proddesc_54245.htm

[A1] http://www.ge-at.iastate.edu/glossary-of-geologic-terms/

[A2] http://geomaps.wr.usgs.gov/parks/misc/glossarya.html

Kings Mark Environmental plan (Create Citation)

Pictures:

[P1] http://geomaps.wr.usgs.gov/parks/rxmin/mineral.html