DRAFT - Academic Framework for Geological Agriculture - DRAFT

Foundation

Geological agriculture is the process of cultivating and growing crops exclusively in gravel or rocks environment.

Relevant Work

Missouri Gravel Bed – This group developed a method of using gravel to store bare root trees during the winter. In the final report, they indicate that the gravel the way they configure it is not a growing method. See report here: http://www.inla1.org/pdf/Starbuck-GrowingTreesGravel.pdf

Agrogeology - The application of geology to agricultural practice, examining how soil nutrients, pH and soil structure can be improved using naturally occurring, mineral-rich rock materials. Rocks such as potash, gypsum, limestone and dolomite are rich in nutrients and can be used as fertilizers – directly added to the soil. One of the biggest challenges is replacing and increasing phosphates in the soil. Geologists can play an important role in identifying, mapping and utilizing phosphate-rich rocks. Rocks such as scoria and pumice can be used to help retain water in the soil, and rocks such as limestone and dolomite can be used to decrease the acidity of the soil, raising the pH. http://www.gfgd.org/key-themes/agrogeology

Remineralize the earth is a nonprofit organization assisting the worldwide movement of remineralizing soils with finely ground rock dust, sea minerals and other natural and sustainable means to increase the growth, health, and nutrient value of all plant life. Adding minerals and trace elements is vital to the creation of fertile soils, healthy crops and forests, and is a key strategy to stabilize the climate. http://remineralize.org/

Relevant Work Summary

1. **Missouri gravel bed** store bare root trees.
2. **Agrogeology** is the method of using rock in soil as fertilizers.
3. **Remineralization** is the process of using rock dust as fertilizers.

Each of these previous methods is close to the process of using rocks only to grow crops. Agrogeology uses rocks in soil and rock dust is put in soil with remineralization. Both use soil in the cultivation process. The Missouri gravel bed states that crop are not grown in crops.

These three methods substantiate the foundation that rocks have nutrients. Geoagriculture takes these processes a step further by using rocks only to grow crops. With previous methods, the rocks are used as fertilizers in soil, but weeds still grow and frequent watering is necessary. With geoagriculture, the rock is the growing medium without the use of soil, where weed growth is reduced with infrequent watering needs.

Scope of Study

Geoagriculture studies the effects of rock, primarily sedimentary, on vegetation roots systems. Within the process is the study of water and its effect on sand and gravel. The nitrogen cycle process is included in the study as the source of nitrogen is critical in plant development. Atmospheric conditions play a role and the impact of the atmosphere can affect nitrogen fixation with the gravel. Root systems development, micro biological analysis and plant nutrient analysis are also included in this study. Geological considerations are paramount as there are many types of rock on the planet with many seemingly having the ability to support plant growth. A host of agriculture realities are included in the study with considerations on growth rates, nutrient transfer, sustainability and resilience with respect to growing crops. Analysis and studies related to the decaying process are needed to reveal the annual effect of enrichment within the gravel system. Other analysis may be required.

Implications of Study

Defining and amplifying the ability of using rocks to grow crops absent of soil, fertilizers, and daily watering can have significant impact on the agriculture landscape. Conservation, sustainability and resiliency are achieved simultaneously with gravel agriculture. With the primary growing material being rock instead of soil, the nutrients that are leach from the rock should come from that rock for decades.

Gravel agriculture can assist with climate change effects, food security issues, farming practices, urban produce, green building designs, landscaping, sustainable agriculture, environmental conservation, and job creation.

Terms

Geoagriculture – The study of rocks to grow vegetation
Geoag – The abbreviated term for geoagriculture
Gravel agriculture – The application of gravel gardening techniques in commercial and residential landscaping environments.
Gravel gardening – The process of using rocks to cultivate vegetation.

Study Discoveries

Geoag is recognized as having the ability to grow crops based on an 18 year process study of cultivating crops, where gravel beds constructed in 1994 have produced crops each year from then to now without adding fertilizers. Initial testing reveals that nutrients are leaching from the gravel and the nutritional value in cucumbers grown was high.

Geoag is in its infancy so there are many questions not yet fully answered and explored. The questions below represents some key questions that the study of geoag seeks to answer. All researchers seeking to expand upon the study of geoag should first read the how to manual to provide the foundation of what we know so far. The questions below are for you to explore and answer on behalf of the science:

1. Does all river based gravel around the world provide the same benefit?
2. What rock type is best?
3. Can this really produce for a lifetime?

4. Is there any structural loss with the rocks?
5. What is it about the rocks specifically that enable nutritional transfer?
6. How far do roots travel in gravel compared to root development in soil?
7. How long does water store in the system before it dries out completely?
8. What are the effects of the decaying process on the health of the gravel bed?
9. Can the sand gravel filtering characteristics have filtering effects on sea water and gray water?
10. How is fertilizer absorbed?
11. Where does the nitrogen come from?
12. Why are there inconsistencies?
13. What is the best balance of moisture with the gravel for best growth?
14. What crops grow best in which type of gravel?
15. How does the growth rate in gravel compare to the growth rate in soil?
16. What is the more precise range of reduction in water use between gravel gardening and traditional gardening?
17. What is the nutritional impact of commonly grown vegetables and fruits?
18. Which gravel type grows which crop type best?
19. What is the potential economic impact of gravel agriculture on society?
20. Where is the best gravel found?
21. What are the effects of natural fertilizers such as peanuts and compost?
22. What at the effects of synthetic fertilizers?
23. What are the greenhouse effects?
24. How do bugs, worm and other pests interface with vegetation in gravel environments?
25. How does gravel perform in commercial applications?
26. What is the impact of heat on rock?
27. Is moisture created when it is higher than 100 degrees and the depth is deeper than 2.5 inches?
28. What is the rate of moisture created at varying gravel depths and heat intensity?
29. What are the effects of varying sand levels to the development of crops or the retention of water?

As academics begin to answers these questions, the benefits of gravel in crop cultivation should continue and grow.

Research Repository – To Soil Less and select academic universities will house research results related to the study of gravel for use to greater society. All researchers are encouraged to share their results so that the collective academic and consumer community can benefit from aggregated research findings.