

Archaeonic: Reconstructing ancient human-environment interactions to sustain modern land use management strategies

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Concept

Archaeonic – is a new term for applied research of the past using a co-adaptive inter- and transdisciplinary approach. The aim of this concept is to investigate past human-environment systems to develop sustainable long term successful strategies with high efficiency, resulting in a minimum of resource use and an expected high capacity of adaption to today's and future environmental management strategies and challenges. The objectives are to reveal new insights and possible implementations to a sustainable energy- and matter flux management in land use, climate protection, and to minimize the use of resources. The concept also focuses on process based research perspective for techniques, socio-economic, and cultural strategies of past land use strategies. In particular, the evaluation of these systems to the vulnerability and resilience of internal and external interferences are important [1].

	System theory	System analysis	S. reconstruction
Design	Creation of hypotheses - Human-Environment-Systems - Resilience Theory - Further theories (history, social sciences etc.)	Development of criteria Cases studies in - Landscape and land use development - Performance - Energy and matter fluxes - Resource use - Waste management	Development of models Analog and virtual models - Land use systems - Trading systems - Resource, waste management and cycle systems - Community systems
Methodology	Abstraction and Modeling - Process dynamic in phase space (Trajectories and Attractors) - Non-linear dynamic modeling (cellular automatic models, agent-based modeling, artificial networks etc..)	Data exploitation, analysis and evaluation - Search and evaluation of data and studies - Interdisciplinary studies (historical studies, (geo)archaeological field studies and related disciplines)	Experiments - Resource use - Energy use - Cop rotation - Land use performance - Soil protection techniques - Social systems
Adaption	- Material flow management (Sanitation & Land use systems) - Zero-Emission-Concepts - Systemic sustainability management - Soil regeneration and soil amelioration - Climate mitigation - Urban Farming - Education		
	Examples: Ridge and Furrow systems Floating Gardens Terra Preta (Anthropogenic Dark Earth) Agroforestry systems		

Example: The Terra Preta Technology

Terra preta do indio are highly sustainable fertile anthrosols, which occur in small patches averaging 20 ha in the central Amazonian basin [2]. This Anthropogenic Dark Earth (ADE) has on average a three times higher content of soil organic matter, higher nutrient levels, a markedly cation exchange capacity and water retention capacity than the surrounding tropical soils [3]. This brings the ADE to a high potential relevance as a model for sustainable soil and land management systems as well as for climate change mitigation on local to global scale. Until now, little is known how the ADE was produced or managed by the Amerindian populations in pre-Columbian times approximately 500 to 2500 years ago [4]. Beside of the Terra Preta in the Amazonian basin, several other areas with ADE have been meanwhile identified. Such areas can be found in different regions of Europe, on the west coast of the USA, in the surrounding of the Black Belt region of southeast USA, Guinea, and Easter Island [5].

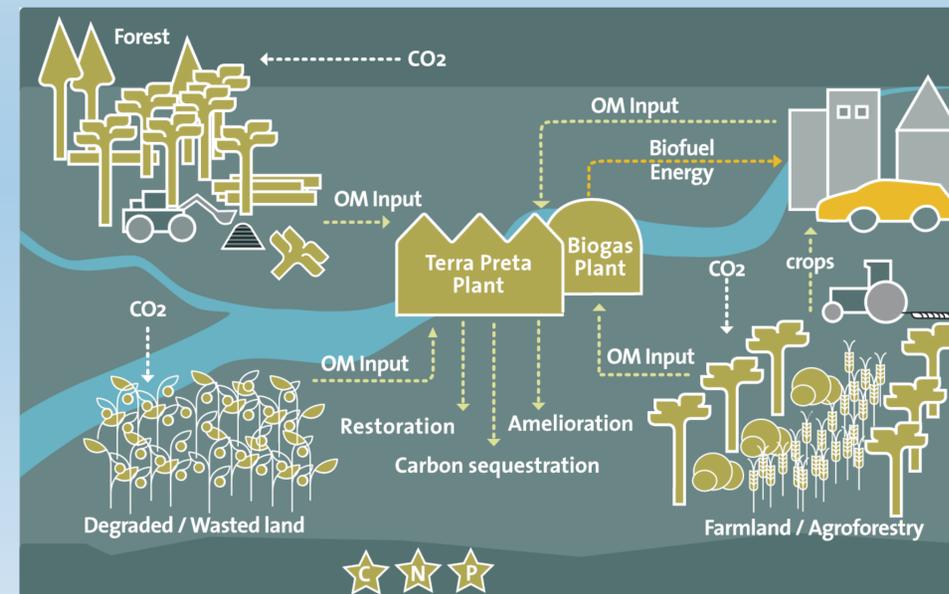
Adaption of ADE on modern systems

Based on the ADE phenomenon a new methodology to produce ADE with the composition of liquid and solid organic waste, charcoal and microbes were developed. Within a few weeks, the composition transforms into a high fertile humic rich and oxidation stable substrate by an anaerobic acid-lactic fermentation [6]. The production and use of TPS allow the development and application of new strategies for soil amelioration and carbon sequestration and emerges new explorations into the understanding of the ADE formation. It provides also innovative perspectives for sustainable life-cycle oriented soil, waste, nutrients, and carbon management strategies [5].

Potentials

In particular, forestry, agriculture, horticulture, and all types of farming and livestock breeding produce high outputs of organic wastes, which are often scarcely or inefficient used. Also, households in small villages as well as fast growing cities, and food industry worldwide generate organic wastes, which can be valorised as input materials to create ADE. Interdisciplinary and comparative studies on different sites with ADE will allow us to get a better understanding of the forming of these soils. In particular the question should focus on

- Resource potentials of past land use system with ADE
- Systemic analysis of past land use systems – questions to sustainability and collapse
- Application of modern ADE for soil amelioration and soil protection



Conclusion

The system theoretical approaches on past human-environment interactions will offer new insights into long-term processes which creates sustainability or collapse. Moreover, in the combination and integration of detailed field, laboratory and historical studies, will provide an entirely new understanding of long lasting ancient soil management strategies. This integrative and interdisciplinary concept of an “applied research on the past” will give groundbreaking amalgamation potentials for modern sustainable land use systems.

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