Synecoculture – Human Augmentation of Ecosystems

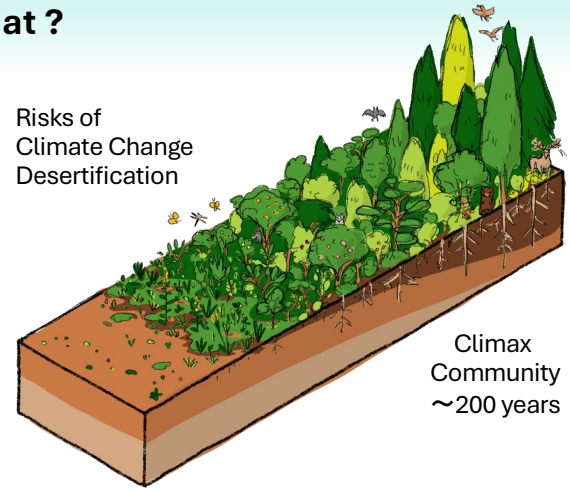
Abstract

The growing urgency of climate change, biodiversity loss, and agricultural unsustainability calls for innovative approaches that transcend traditional disciplinary boundaries. This poster presents the Synecoculture project through the lens of complex systems science and its real-world implementation. Synecoculture is grounded in the open complex systems paradigm, integrating physiological and ecological dynamics to reconcile agronomic and ecological definitions of productivity. By cultivating dense, mixed polycultures of up to 200 edible plant species per 1,000 m^2 year-round, Synecoculture exemplifies a biodiversity-intensive approach supported by network- and AI-based management systems. By fostering environments where diverse plant species grow synergistically, this method enhances multifunctional ecosystem processes and integrally delivers a variety of ecosystem services. It results in an *augmented ecosystem*—one that exhibits both greater diversity and utility than many natural ecosystems.

What ?

Natural Ecosystem

Risks of
Climate Change
Desertification



Climax
Community
～200 years

Positive
Human
Activities

Augmented Ecosystem

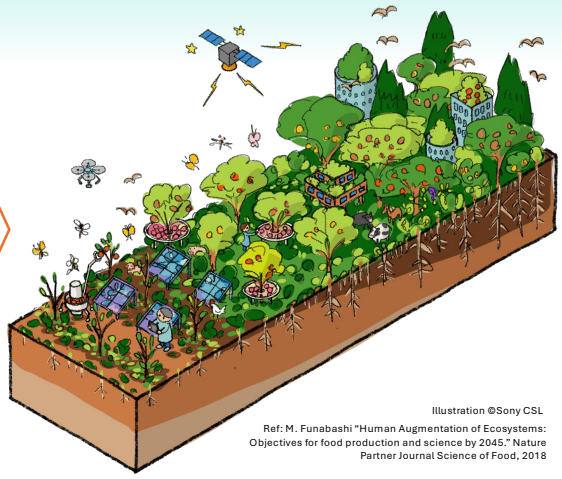


Illustration ©Sony CSL

Ref: M. Funabashi "Human Augmentation of Ecosystems: Objectives for food production and science by 2045." Nature Partner Journal Science of Food, 2018

Where ?

More than 60 pilot farms are established in Japan, 18 African countries, China, Indonesia, and South America

Synecoculture Experiment in Burkina Faso

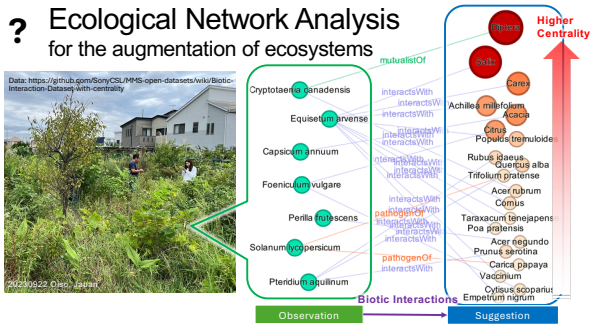
Ref: M. Funabashi "Power-law productivity of highly biodiverse agroecosystems supports land recovery and climate resilience." Nature Partner Journal Sustainable Agriculture, 2024

Synecoculture Introduction in Mauritania

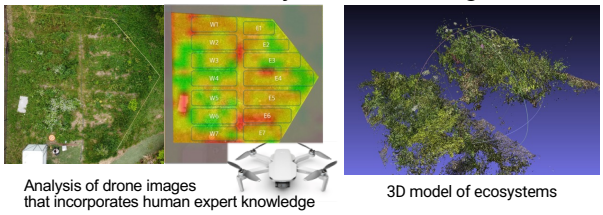
Pictures: CARFS

How ?

Ecological Network Analysis
for the augmentation of ecosystems



AI-based Field Analysis and Management

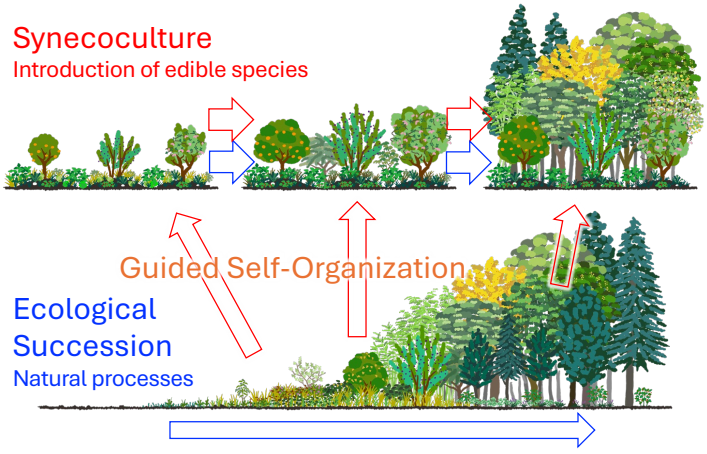


Analysis of drone images
that incorporates human expert knowledge

3D model of ecosystems

Ref: Aotake, S., Takanishi, A., Funabashi, M. (2023). Modeling Ecosystem Management Based on the Integration of Image Analysis and Human Subjective Evaluation - Case Studies with Synecological Farming. In: Collet, P., Gardashova, L., El Zant, S., Abdulkarimova, U. (eds) Complex Computational Ecosystems. CCE 2023. Lecture Notes in Computer Science, vol 13927. Springer, Cham.

Synecoculture
Introduction of edible species



Why ?

Smallholders managing less than 5 ha represent over 90% of global agricultural holdings, yet they are often excluded from scientific and business innovations. Synecoculture empowers these long-tail food producers by offering a scalable, biodiversity-based approach to agriculture that addresses the SDGs and helps bridge growing economic and social disparities—ensuring no one is left behind.

Who ?

Sony CSL

Centre Africain de Recherche et de Formation en Synécoculture

SYNECOCULTURE ASSOCIATION

京都大学 KYOTO UNIVERSITY

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