PLANT SIGNALING & BEHAVIOR
2018, VOL. 13, NO. 4, e1237330 (2 pages)
https://doi.org/10.1080/15592324.2016.1237330

Taylor & Francis
Taylor & Francis Group

CONCEPT PAPER

Ships as future floating farm systems?

Khaled Moustafa

Conservatoire National des Arts et Métiers, Paris, France

ABSTRACT
Environmental and agriculture challenges such as severe drought, desertification, sprawling cities and shrinking arable lands in large regions in the world compel us to think about alternative and sustainable farming systems. Ongoing projects to build floating cities in the sea suggest that building specific ships for farming purposes (as farming ships or farming boats) would also be attainable to introduce new farming surfaces and boost food production worldwide to cope with food insecurity issues.

ARTICLE HISTORY
Received 22 August 2016
Accepted 12 September 2016

KEYWORDS
Alternative farming; farming boat; farming ship; floating agriculture; floating city; floating farm; floating greenhouse; sea farming

Despite important advances in sustainable approaches, humanity is still mostly on unsustainable development trajectories.[1] This might be due, at least in part, to the absence of adaptive management and complex challenges that hamper the balance between development and conservation goals.[2] Climate change, desertification, drought effects, dwindling arable lands and freshwater shortage in vast regions in the world are strong incentives to develop innovative and sustainable farming systems to ensure food supply and cope with environmental hazards. There is plenty of evidence in the scientific literature of strong interest in developing sustainable and cleaner production systems.[3,4] One strategy toward this goal is to invest in 'grand experiments' where knowledge from different domains could be combined to pilot sustainable development and to test hypotheses that could improve food production while maintaining safe operating space.[5]

Among the potential 'grand experiments' to be explored in this direction could be the establishment of ships as possible sustainable floating farm systems to deal with the many current and future food and agriculture challenges. As ship industry and greenhouse facilities are well-advanced technologies, it might be worthwhile to combine knowledge in both fields to build ships for farming purposes in the sea. The establishment of ships as potential farming platforms would thus provide new and important opportunities for food production and environmental sustainability enhancements. To reach such aims, we simply need to adapt technologies already in use in ship industry and greenhouse facilities to construct and manage "floating greenhouses" in the form of floating ships (farming ships or farming boats). Potential farming structures could offer many environmental and sustainable advantages, including for example but not limited to: 1) reduce the burden on the freshwater by using seawater desalination techniques or by collecting and storing rainwater, 2) introduce new cultivable surfaces where arable lands and freshwater are scarce, particularly in arid and dry regions, 3) provide complete and self-sufficient farming systems in terms of automated planting, harvesting, processing and export; a big farming boat, for example, of 300m length by 200m width and 50m height, and designed to hold 10 vertically tiered-cultivable layers could provide about 60 hectares of cultivable surface in less than 0.06 km square of sea space (one hectare is a surface of 100m* 100m). To take advantages from seawater as an inexhaustible source of freshwater, combing photovoltaic desalination technology to a floating farm ship could also be considered particularly for dry and sunny regions.[6] Floating greenhouses could be designed as multi-level vertical systems to increase the overall farming surface, thus yield, and making the floating farm approach economically viable.

It might be conceivable that a farming ship could be planted with a crop species while it is anchored in a region with intense insolation and, then, just before the crop matures or becomes harvestable or ready for consumption, the farming ship could move to export the onboard growing crop timely. On the return trip, a new crop could be planted on board and so on. The movability aspect indeed is an important feature in farming ships as it should allow farming boats to move to new safer and more adapted locations when a specific location is no more suitable for whatever reasons (environmental or pollution risks, political conflicts, etc.). If floating farms are built with photovoltaic panels or with marine energy source (wind and tide-generated energy) to desalinate seawater, farming ships could reduce the reliance on polluting fossil fuels and decrease the emission of CO_2 significantly if adopted at large scales. Potential inconveniences, however, of such systems may include high costs, farming suitability limited to herbaceous and/or small-sized crop or vegetable species, and high energy requirements for movement. Nonetheless, farming ships could be designed to be anchored in suitable locations (i.e., sunny and safe positions) and movable only at urgent needs. Given many environmental and agricultural benefits, the advantages of farming ships would overweight its inconveniences at least from a long-term perspective.

CONTACT Khaled Moustafa khaled.moustafa@gmail.com Conservatoire National des Arts et Métiers, Paris, France.

Farming ships could be an effective solution to many current and future societal, environmental and agricultural issues related to land deterioration, drought, desertification and sprawling cities. Ongoing projects to build floating cities* and floating hotels† in the sea suggest that building ships for farming purposes in the sea could be more realistic and cheaper than building full floating cities because farming ships need much less infrastructure than full floating cities. Recently, it was announced that the world biggest salmon producer, Marine Harvest ASA, opts for fish farming inside cargo Ship‡. Although fish farming is different from crop farming but ship assembly and greenhouse farming technologies are well developed conceptions that could be adapted for crop farming in the sea as floating ships or floating greenhouses.

Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

References

1. Abson DJ, Fischer J, Leventon J, Newig J, Schomerus T, Vilsmaier U, von Wehrden H, Abernethy P, Ives CD, Jager NW, et al. Leverage points for sustainability transformation. Ambio 2016; PMID:27344324; https://doi.org/10.1007/s13280-016-0800-y
2. Williams BK, Brown ED. Adaptive management: from more talk to real action. Environmental Management 2014; 53:465-79; PMID:24271618; https://doi.org/10.1007/s00267-013-0205-7
3. Tan RR. Decision analysis for sustainable systems: making smarter choices for the planet. Clean Technologies Environmental Policy 2016; 18:1245-6; https://doi.org/10.1007/s10098-016-1253-5
4. Nemet A, Varbanov PS, Klemeš JJ. Cleaner production, process integration and intensification. Clean Technologies Environmental Policy 2016:1-7; https://doi.org/10.1007/s10098-016-1240-x
5. Rockstrom J, et al. Sustainable intensification of agriculture for human prosperity and global sustainability. Ambio 2016; HYPERLINK "http://www.ncbi.nlm.nih.gov/pubmed/27405653" PMID:27405653; https://doi.org/10.1007/s13280-016-0793-6

*http://www.seasteading.org/floating-city-project
†http://www.thecoolist.com/floating-hotels-10-aquatic-escapes-of-luxury-and-adventure/
‡http://www.asf.ca/farm-fish-inside-cargo-ship.html