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Adapting To Sea Level Rise: Economic and Ecological Roles for Seashore Mallow

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Although seashore mallow is used in inland saline or non-saline situations, these thoughts are particularly about problems driven by climate change and sea level rise and their impact on the coastal ecotone. As sea level rises, perhaps at a more rapid rate than earlier in our lives, low-lying farm fields that are often very productive under dry land cultivation and their buffers will become salinized, as will rivers and some aquifers. Non-salt-tolerant nutrient management buffers between housing and other development will be lost and perhaps replaced by invasive species.

Recent storm tides provide such evidence in coastal farm fields where, unless a "nurse crop" is present to encourage the growth of desirable wetland plants, Phragmites often colonizes the vacated land and in woodland borders. These thoughts have led us to use the term "self-subsidizing" and to look for multiple products and services that could be obtained from seashore mallow to subsidize the cost of making the biodiesel. In fact, these goods and services may exceed the EE value of the biofuel.The diagram below shows our latest array of products and services identified for seashore mallow. Some are well-researched, and some are not yet examined in depth.

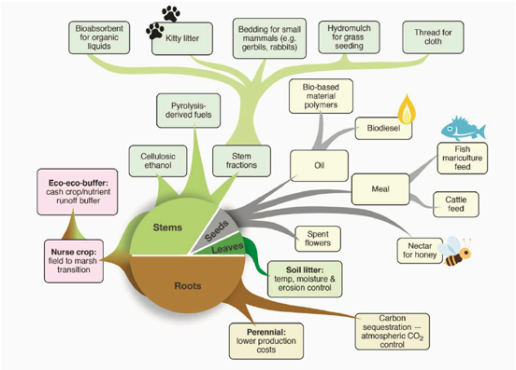

Figure 1: The diagram shows our latest array of products and services identified for seashore mallow. Some are well researched and some are not yet examined in depth.

The series of bullets below gives an idea of the depth of investigation of the products and ecosystem.

Mallow Products

- Oil – work in collaboration with Bryan Moser at the Bio-Oils Research Unit at the National Center for Agricultural Utilization Research (NCAUR), USDA in Peoria. Mallow seeds from Delaware were used as a feedstock for the production of biodiesel, and blends with petrodiesel were tested. Results were published in Renewable Energy (Moser et al. 2013). Bryan says oil extraction and conversion can be easily integrated into soy processing.
- Cellulosic ethanol - Bruce Dien at NCAUR did this work, and it is published in the same article as the biodiesel work. The outer part of the stem gave good yields, but the core yield was very low, hence he involved Stephen Vaughn in working on other uses of the stem.
- Stem fractions - Steve chopped the stems into pieces and separated them into size fractions. The finer fraction of the core was very effective as an absorbent for organic liquids and for kitty litter. Steve said mallow was the most absorbent material he has evaluated for that purpose. A manuscript by Steve and our group is available about this work, and that about the bedding litter and hydromulch (Vaughn et al. 2013, Biomass and Bioenergy). The bedding had a slow compressibility and an unusual rebound quality when applied weight was removed. It was also tested for poultry litter by Bill Brown (University of

Delaware) and was found to be more absorbent than sawdust, straw, and other materials tested. The outer bark has been made into thread for cloth by a group we collaborated with in China, where we introduced mallow as a crop for newly "reclaimed "coastal soils (Qin, Pei, pers. comm., Nanjing University)

- Pyrolysis-derived fuels- Rudy Behrens of the B.E.A.R. The group evaluated the straw of seashore mallow for this purpose.
- Bio-based polymers – The oil has been suggested as a candidate for polymer production by chemical engineers (Wool, pers. comm., University of Delaware).
- Meal - Analysis of the meal by several groups indicates a good amino acid spread and possibility for use of mammals. It has been suggested that the use by cattle is limited to a fraction of the protein because of the residual oil left when it is crushed. However, a salmon aquaculturist said the residual oil would not be a problem with his animals since their natural food is high in oil content.
- Honey -Nectar production is high, and many bees and other insects are involved with pollination, however insects are not necessary since self pollination occurs readily.
- Spent flowers -Uses for the spent flowers are being explored.
- Roots-These sequester atmospheric CO2 to compensate for gases released by the fuel produced. Roots may be investigated as a source of gums and other products for extraction when the perennial has reached a point where replanting is being considered.

Mallow Ecosystem Services

- Eco-eco-buffer – Used as a crop at the upper ecotonal edge, seashore mallow absorbs nutrients moving either way across the boundary and harvesting seeds and stems cycles the nutrients away from the zone. Thus, these nutrients do not wash into the aquatic phase in flooding water or runoff either as particulate or dissolved components after decomposition.
- Nurse Crop – Graduate student, Nicole Voutsina, did her three-year thesis study on this ecosystem engineering role of mallow. A manuscript on the topic appears in Estuaries and Coasts (2015).

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About the Authors

After more than three decades of research on salt-tolerant plants, Jack and Denise are retired and living in Lewes, DE.

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About this Publication

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