



Destination Green

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Sustainable Bioenergy Research Consortium

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Introduction



- The Sustainable Bioenergy Research Consortium was established by the Masdar Institute of Science and Technology
- The SBRC is focused on research in sustainable biofuels and biomaterials derived from the conversion of plant oils and biomass
- The research and programmatic direction of the SBRC is set by the Advisory Board composed of its members



Members



AEROSPACE · DEFENCE · SECURITY



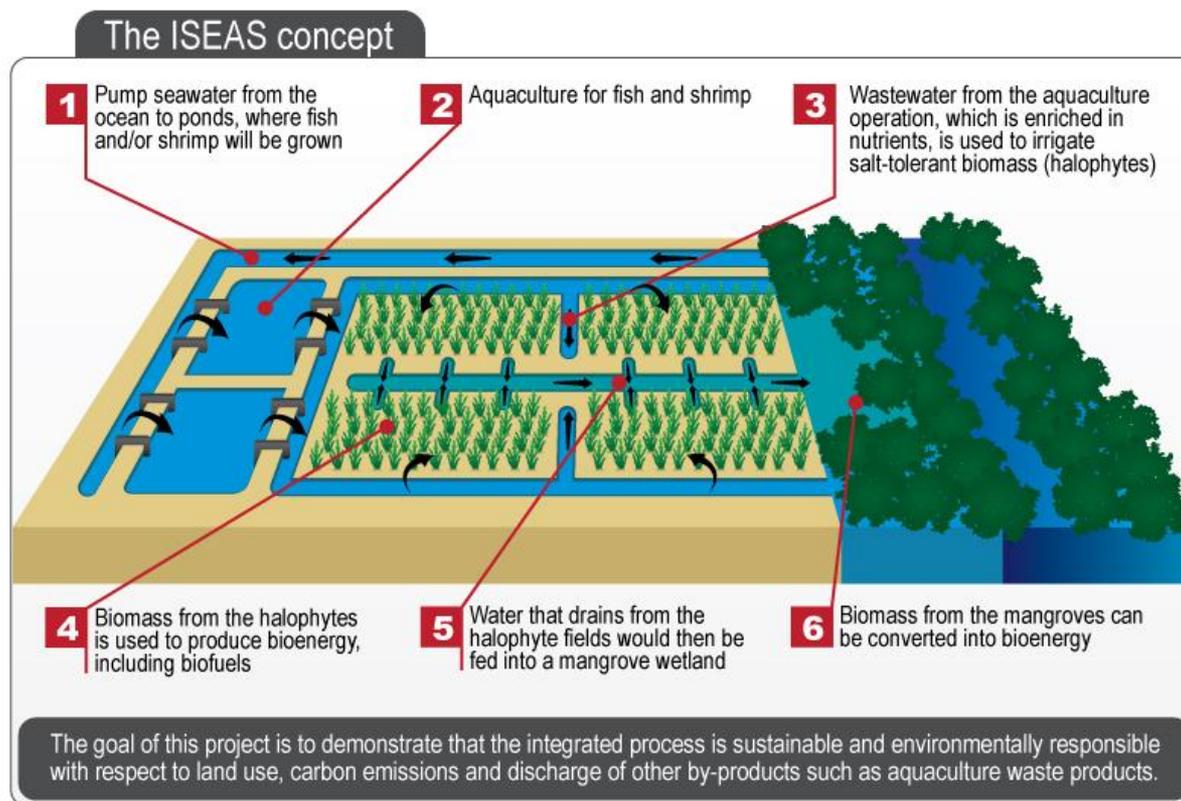


Objectives



- Be the leading research consortium for the development of terrestrial salt-tolerant biomass for bioenergy
- Use a systems focus and applied research for making technology commercialization routes possible
- Concentrate on the optimization of pathways to deliver sustainable alternative fuels for aviation

■ Integrated Seawater Energy and Agriculture System





Research projects

- P1: Field-Scale Salt and Water Balance during Integrated Seawater Farming in Coastal Regions of Abu Dhabi
- P2: Screening oilseed halophytes for production under seawater irrigation in the United Arab Emirates
- P3: Anaerobic digestion as key technology for nutrient and energy recovery in the Integrated Seawater Energy & Agriculture System (ISEAS) project
- P4: Bioenergy production from high salinity lignocellulosic biomass: *Salicornia bigelovii* and *Avicennia marina*
- P5: Molecular and Biochemical Screening of Mangrove Sediments in Abu Dhabi for Biomass Degrading Enzymes



Questions **Thank you!**

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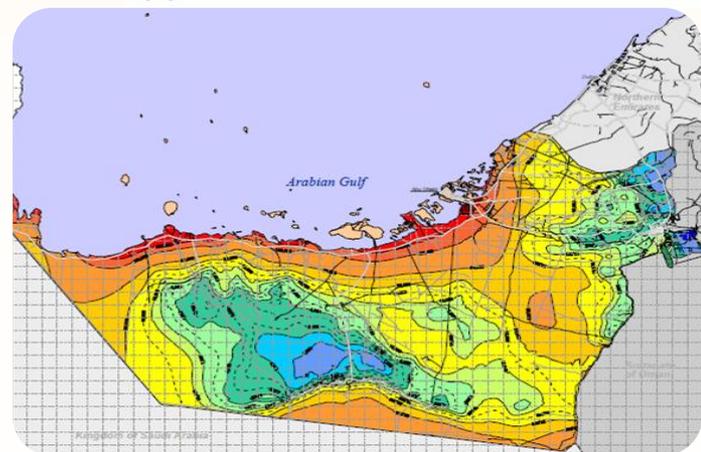
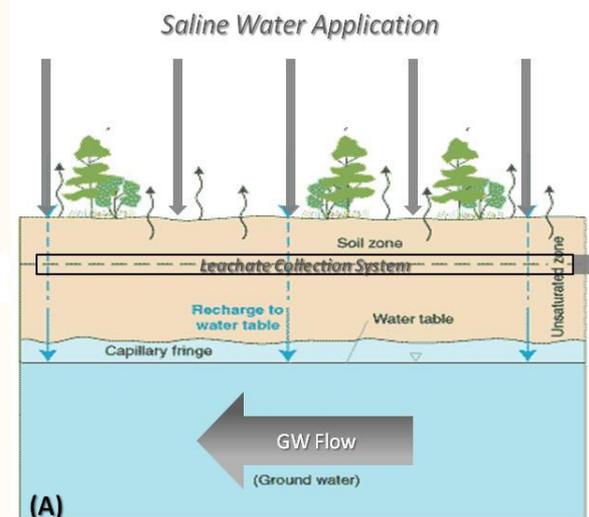
Field-Scale Salt and Water Balance during Integrated Seawater Farming in Coastal Regions of Abu Dhabi

Principal Investigator: Farrukh Ahmad

- Prolonged application of seawater leads to saline-sodic conditions in soil
- Sodic conditions can impair water drainage through the soil

This research project seeks to:

- Find field-scale budget of root-zone & vadose-zone soil for:
 - A. Salt
 - B. Water
- Create a salt deposition and drainage water quality model to predict and plan operational performance



Screening oilseed halophytes for production in the UAE using seawater irrigation

Principal Investigator: J. Jed Brown

Identify oilseed-producing halophytes that can use seawater irrigation in Abu Dhabi

- Oilseeds → oil → jet fuel via Bio-SPK pathway

Questions and Comments

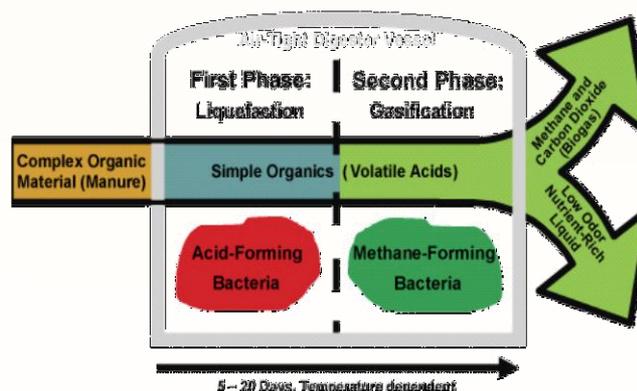
- 1) Screen populations of *Salicornia bigelovii* for production in UAE
 - Assemble a large number of spatially-distinct populations to evaluate genetic variation among them, and use them to develop a breeding/selection program
- 2) Screen local native halophytes for production in the UAE
 - Address limitations of *Salicornia bigelovii* (no seed set in summer)



Anaerobic digestion as key technology for nutrient and energy recovery in the ISEAS

Principal Investigator: Jorge Rodríguez

- Assessment of the **potential of anaerobic digestion (AD)** to add value to an ISEAS by production of biogas and recovery of nutrients and carbon from the system
- Detailed **mechanistic model** that accurately describes the dynamics of the anaerobic digestion of halophyte biomass
- Characterisation of the **microbial community** functionality responsible for high yield and rate of biogas production and nutrient recovery





Bioenergy production from high salinity lignocellulosic biomass: *Salicornia bigelovii* and *Avicennia marina*



Principal Investigator: Mette Thomsen

The idea is to find a process that significantly contributes to the sustainability and viability of ISEAS by utilizing elements of the system that would otherwise represent a waste problem.

High salinity biomass refineries can be highly relevant in arid coastal areas

1. To develop an efficient pretreatment method for extraction of mineral salts and hemicellulose sugars from the lignocellulosic fraction of *Salicornia bigelovii* and *Avicennia marina*, producing a “clean” fiber (cellulose) fraction
2. Screening of different microbial systems for bioenergy production from high salinity hydrolyzate of pretreated biomass of *Salicornia bigelovii* and *Avicennia marina*, as well as optimization of selected systems for enhanced biofuels production





Molecular and Biochemical Screening of Mangrove Sediments in Abu Dhabi for Biomass Degrading Enzymes



Principal Investigator: Lina Yousef

- Find novel biomass deconstruction enzymes and genes suitable for halophytic feedstocks
 - Investigate extreme environments for biomass degrading enzymes that naturally exhibit such properties (salt, temperature, pH)
1. Metagenomics - study of genomic content of all organisms in the soil sample (tells us who is there)
 2. Metatranscriptomics - study of mRNA content of all organisms - tells us which genes are active (tells us what the organisms are doing)
 3. Metaproteomics - study of all proteins in the sample concurrently (also tells us what the organisms are doing)
 4. Bioinformatics - helps analyze and catalogue the biological pathways and networks

