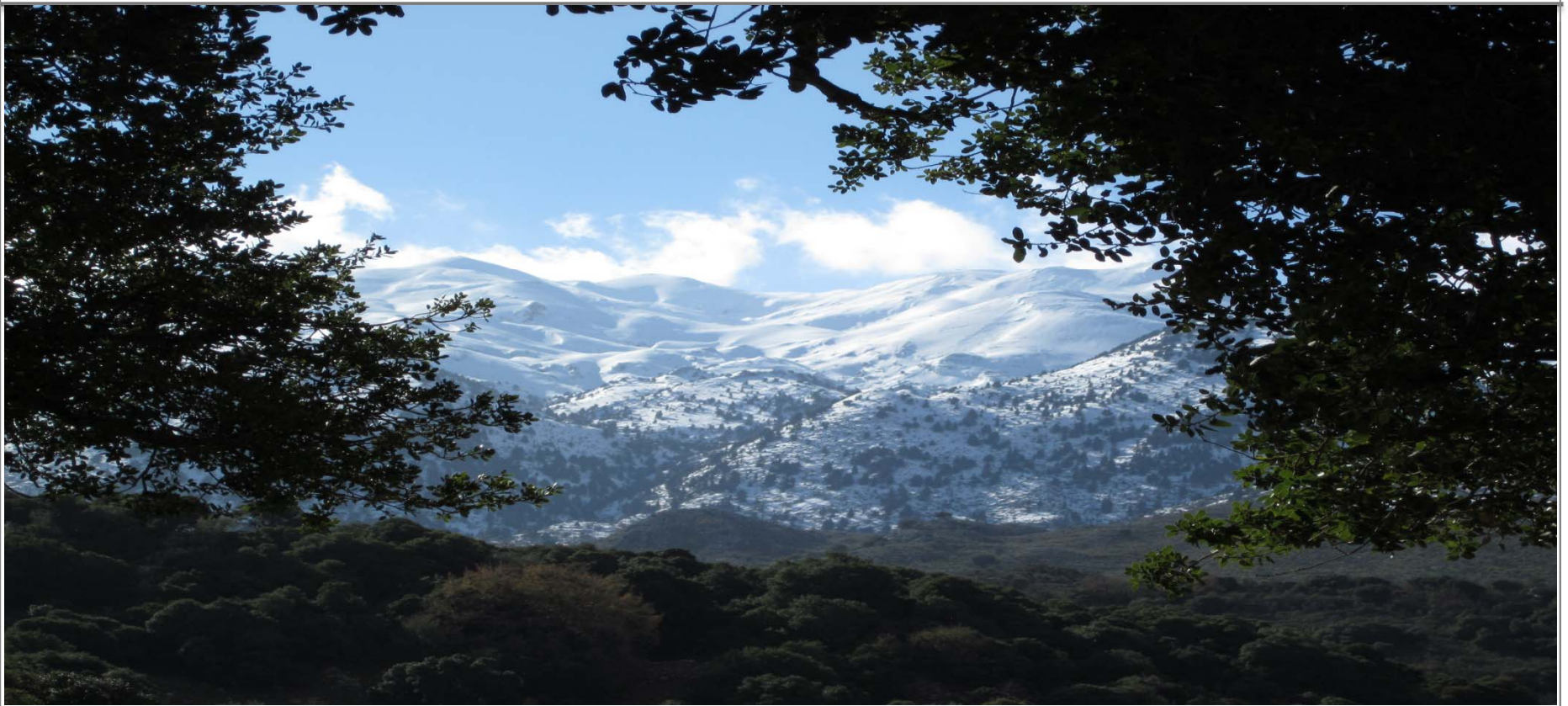




Meeting of Coordinators Urban, Soil, Desertification and Land Degradation Brussels 22 -23 Oct. 2012



Soils Research @ Koiliaris CZO



www.Koiliaris-CZO.tuc.gr

Critical Zone Observatories...

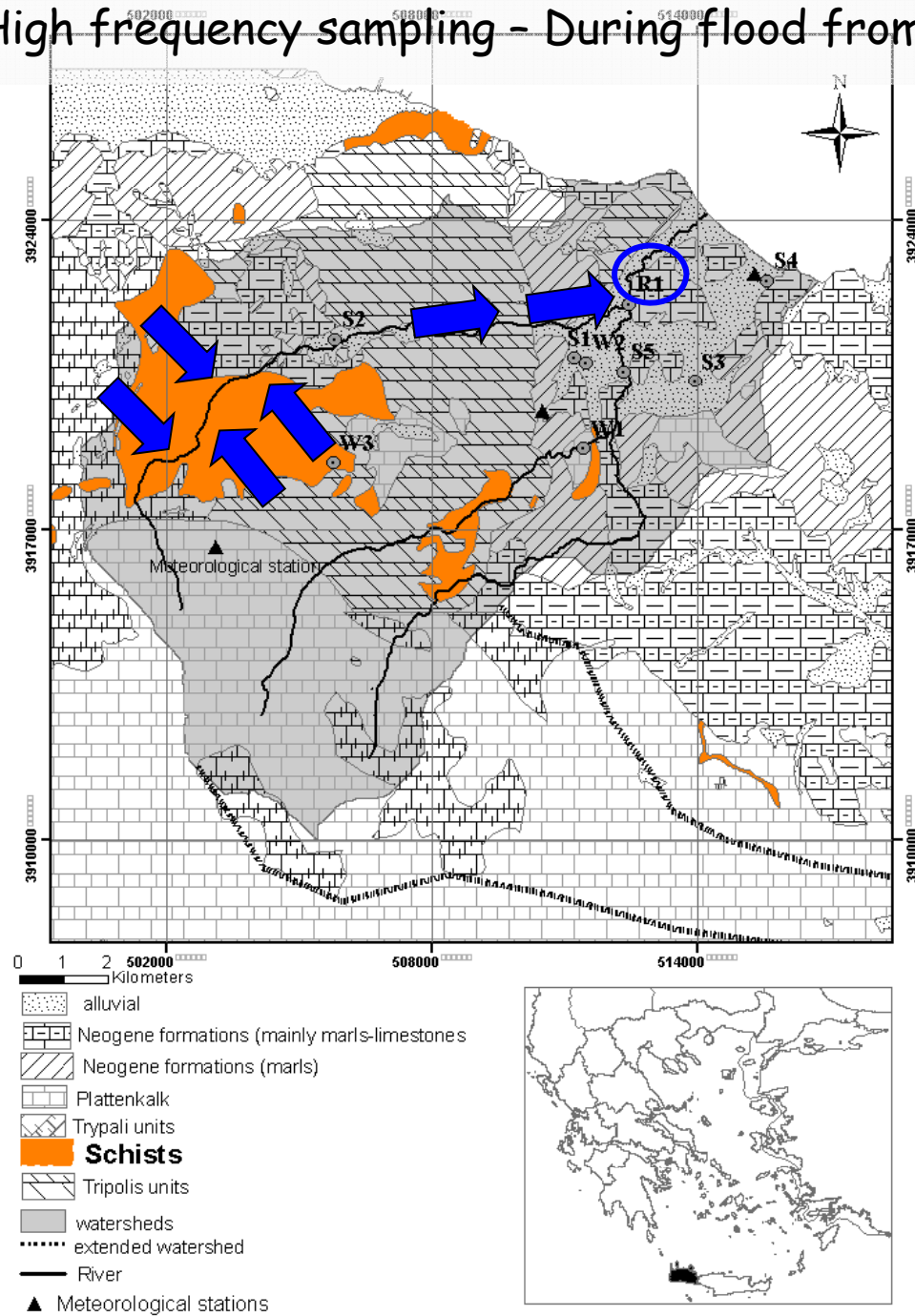
Platform for

- research,
- education - training and
- technology demonstration and outreach



Research

High frequency sampling - During flood from schists





2400 yr \pm 400 yr old

Cultivated w/ irrigation,
10 m, **Fluvisol**

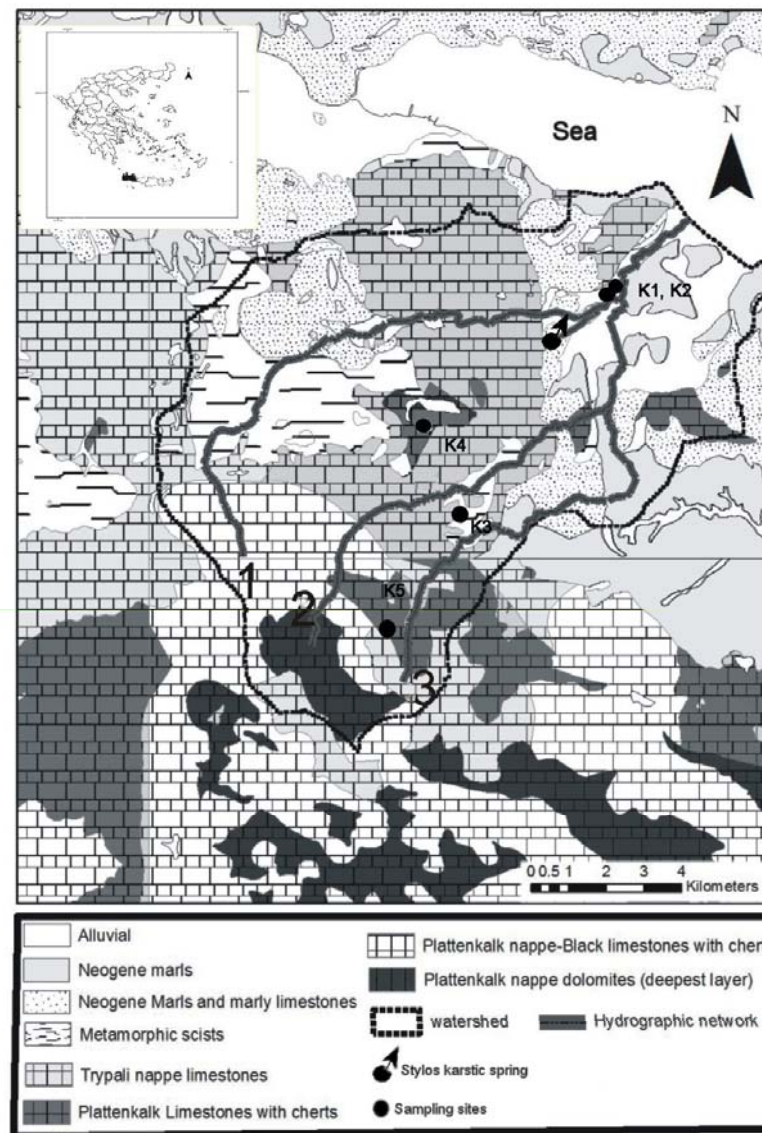


1400 yr \pm 400 yr old

Cultivated w/ irrigation,
9 m **Fluvisol**



20 years old olive trees,
550 m, **Leptosol**



Terrace w/ olive
trees, 465 m,
Cambisol

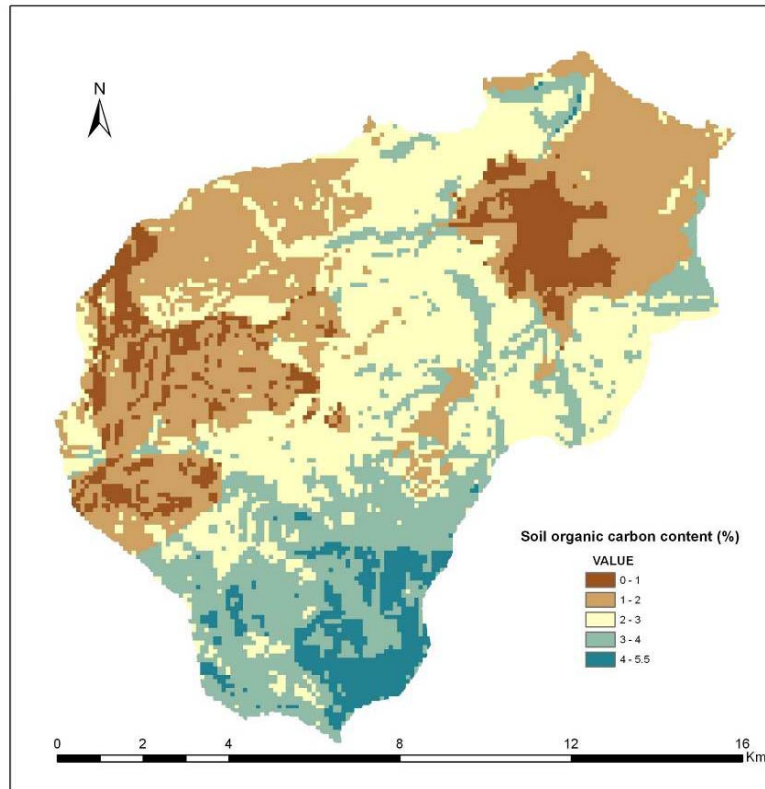
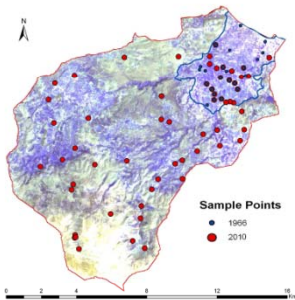


600 yr \pm 100 yr old

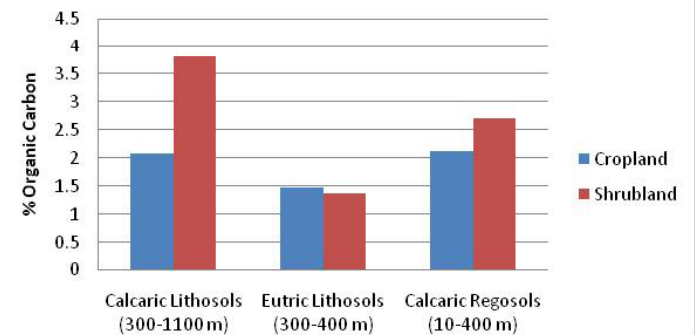
Terrace w/ permanent
grassland and sparse
tree/shrub cover, 1065
Cambisol

- Pedological (profile description),
- Geochemical (including Rare Earth Elements and other trace elements)
- Textural and physical (water stable aggregates, S-index),
- Mineralogical and chronological analysis (optical luminescence dating).

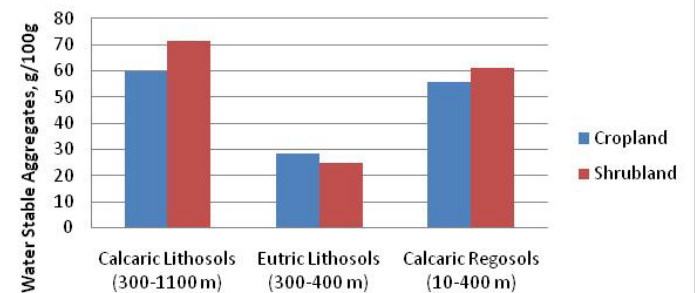
Koiliaris-CZO Soil Surveys



Koiliaris CZO - % OC



Koiliaris CZO - Water Stable Aggregates

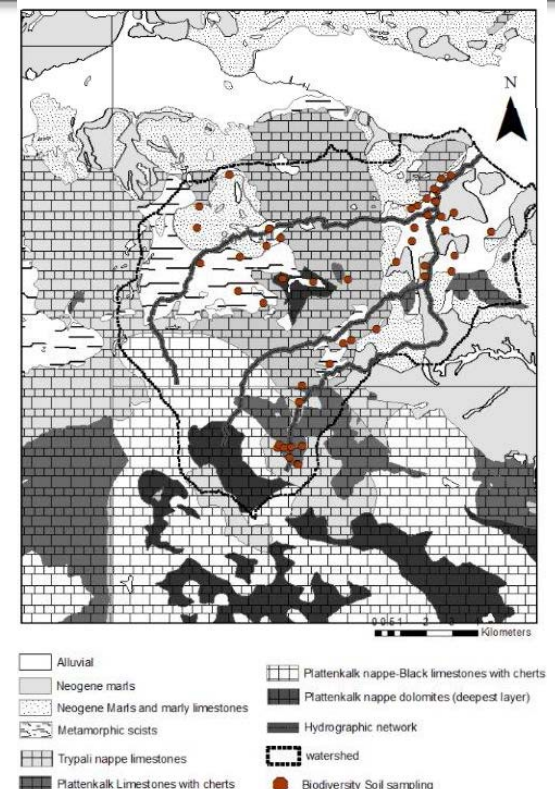


Ece et al., 2011

Stamati et al., 2011

Biodiversity Survey - Analyses

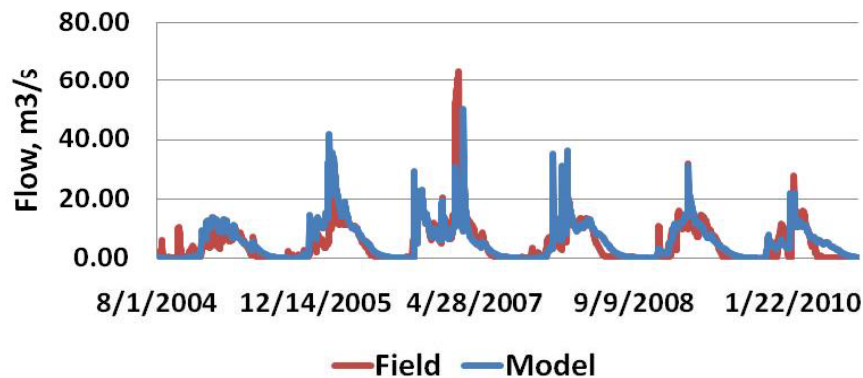
- Physico-chemical properties: texture, bulk density, XRF, pH, EC, TOC, TN, $\text{NO}_3\text{-N}$, and $\text{NH}_4^+\text{-N}$
- Biochemical: Potential nitrification rate; net nitrification rate; net mineralization rate
- Molecular: qRT-PCR of Bacteria, Archaea and Fungi, α -Proteobacteria, β -Proteobacteria, Actinobacteria, Firmicutes, Bacteroidetes, Acidobacteria
- Molecular analyses of N and C cycling genes: qRT-PCR of laccase, nirK, nirS, nosZ, archaeal-amoA, and bacterial-amoA genes



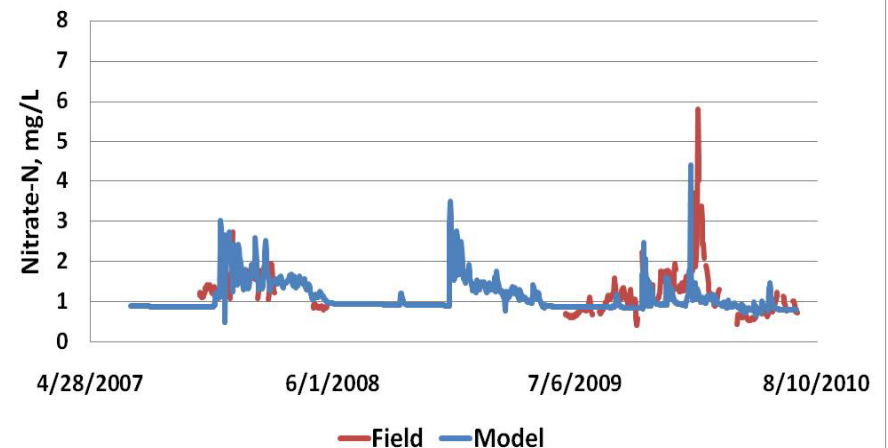


Hydrologic and Nutrient Modeling with SWAT

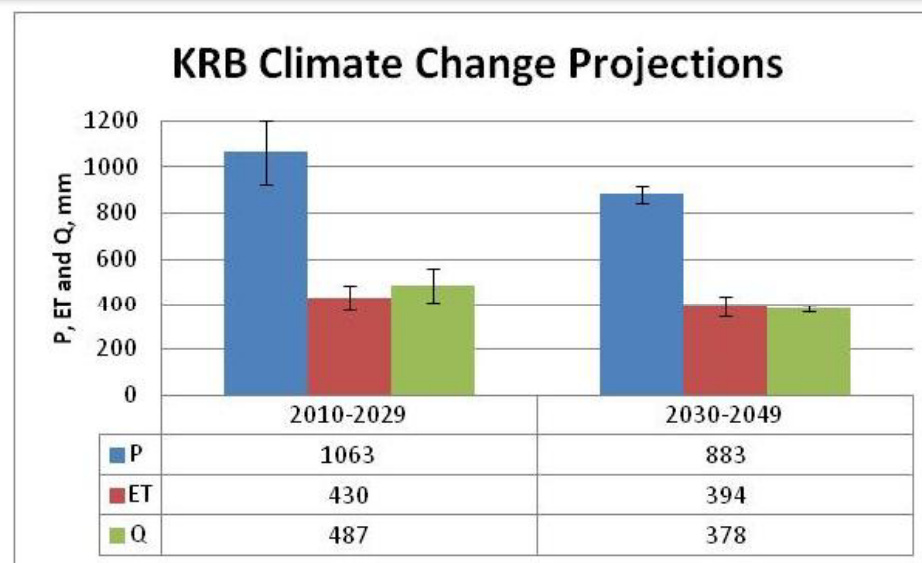
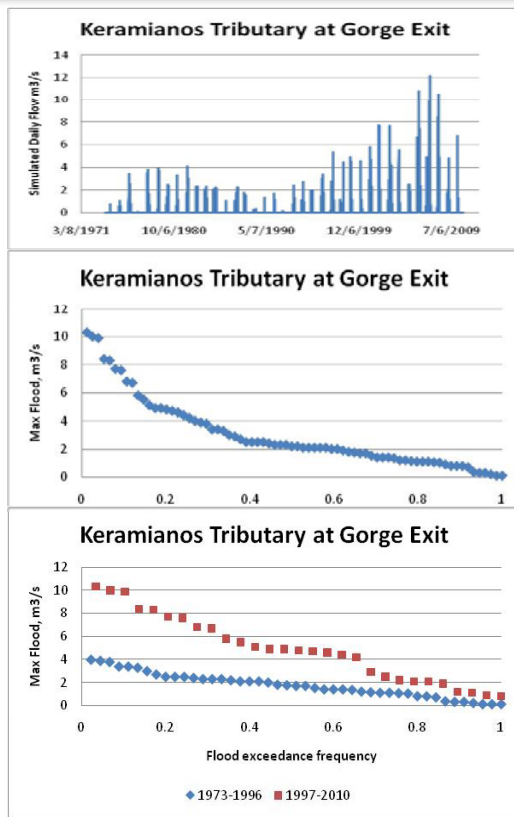
Koiliaris CZO - Hydrologic Simulation



Koiliaris CZO - River NO₃-N



Climate Change Impacts

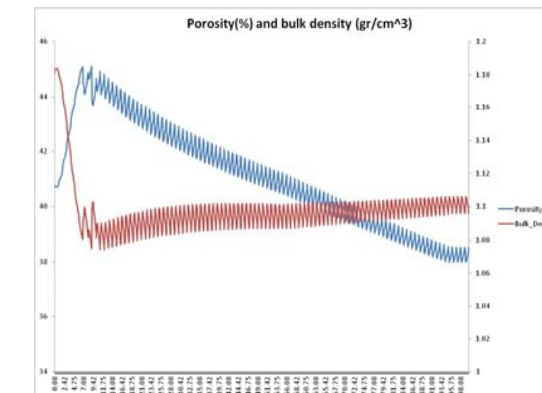
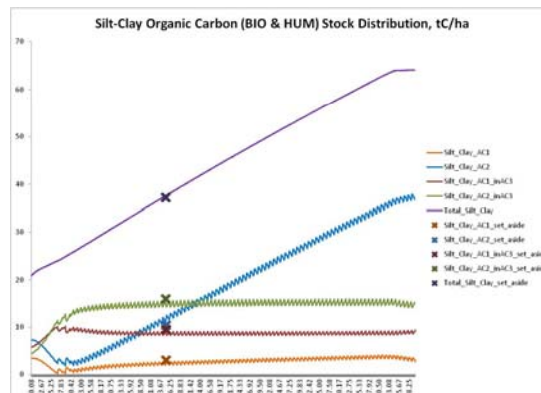
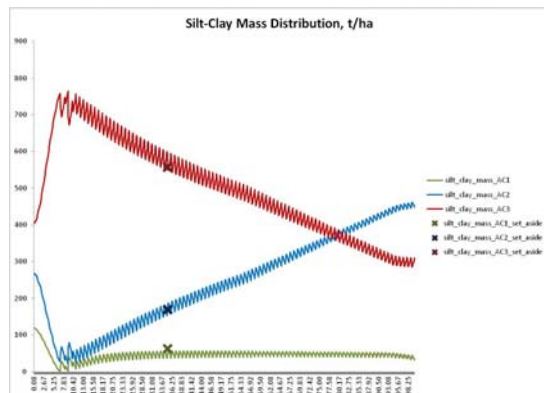
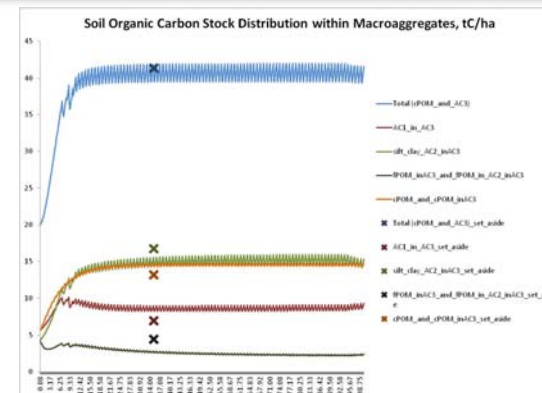
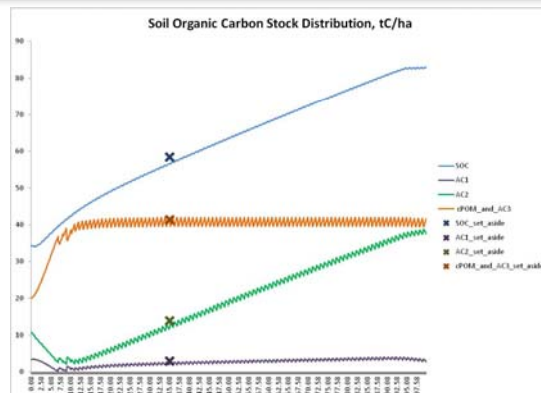
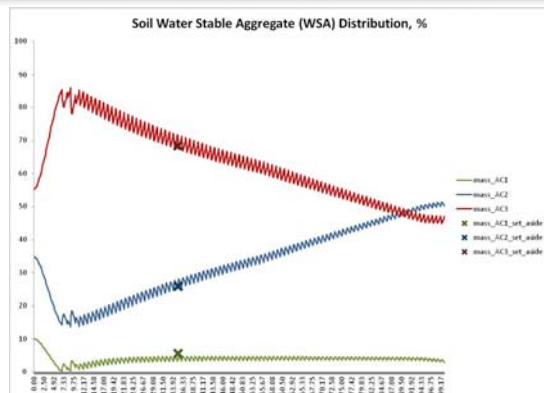


**10% decrease in precipitation,
4% decrease in ET and
19% decrease in Q-
Comparison 2030-2050 with 2010-2020**

Climate Change 1976-2010 - Increase of daily minimum temperature by 2-3 °C

CAST Model - Simulation Results

C and WSA distributions, GR





Education and Training



SoilTrEC-NSF Workshop on Reactive Transport – July 2012





SoilTrEC-NSF Workshop Technical University of Crete and PennState University



Advanced Education



Experiential Learning

Community Building





Technology Demonstration and Outreach

Carbon Amendments - Soil Fertility and Structure

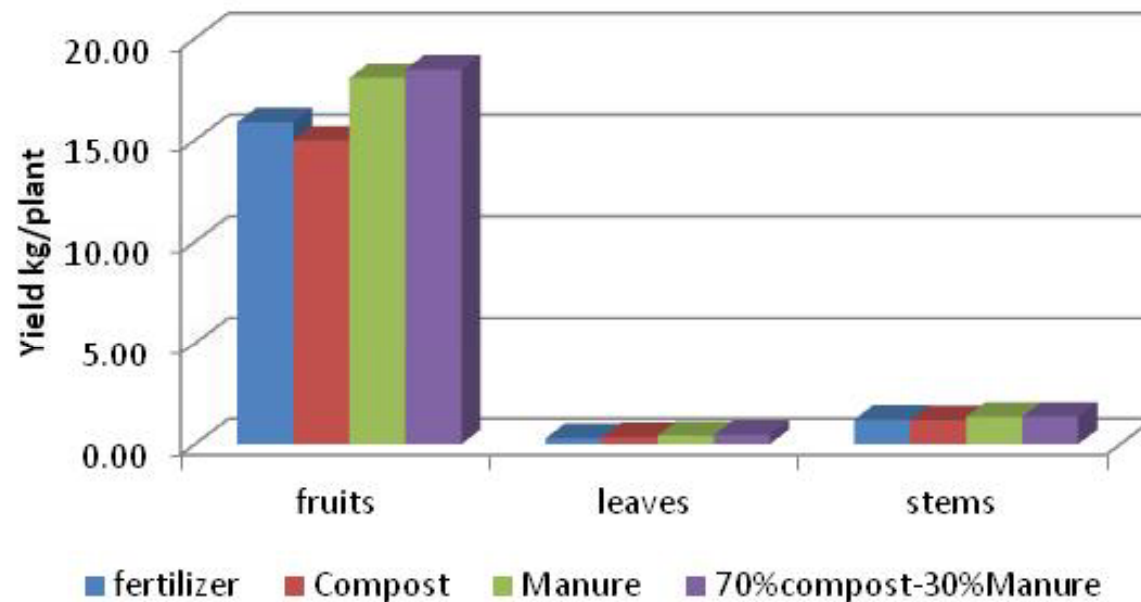


Properties

Water content profiles
Field capacity
Bulk density
Soil texture
WSA determination
Soil pH and electrical conductivity
Organic C and total N
Extractable P
PMN (Potential Mineralizable Nitrogen)
EMN (Exchangeable Mineral Nitrogen)
Net N mineralization rate
Net nitrification rate
Bulk chemical analysis

Carbon Amendments - Soil Fertility 2012 Experiment

2012 Soil Fertility Experiment - Tomatoes



- 200 Kg N fertilizer/ha
- 50 t dry compost, manure or mixture /ha
- 16% higher production mixture vs fertilizer

Roadblocks to sustainability...

Closing the nutrient loop between Urban and Peri-urban areas

- composting of biosolids,
- composting of organic fraction of municipal solid wastes vs energy production,
- collection of bulking agents (wood trimmings)
- free range livestock raising and collection of animal excreta

Roadblocks to sustainability...

Energy Input on Investment

- fragmented farms,
- amateur farmers (220 total farmers - 2 full time),
- maintenance of equipment and use of gasoline
- approximate farming methods - use of fertilizers, coffee shop knowledge

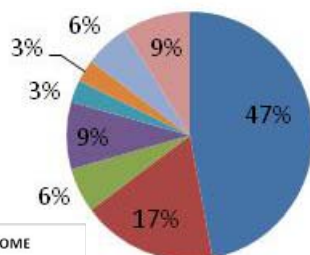
Roadblocks to sustainability...

Farming practices

- lost knowledge and experience on agroecological principles of farming,
- lack of institutional support (ie. Role of Ministry of Agriculture changed from guidance and scientific support to transferring subsidies),
- use of compost - lack of knowledge and trust
- attitudes: know-it-all (I have the expertise) and no-risk (the government should tell me what to do and finance the change)

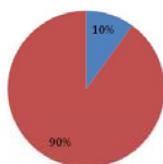
Roadblocks to sustainability...

FERTILIZATION INFORMATION SOURCES

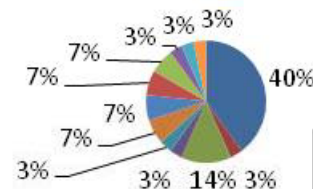


SATISFACTION FROM AGRICULTURAL INCOME

■ YES ■ NO

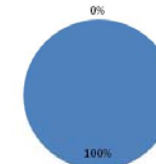


CONDITIONS FOR ADOPTION



ADAPTION OF ALTERNATIVE FARMING METHODS

■ YES ■ NO



Implementation Deficit of Policies

Roadblocks to sustainability...

Product Branding and Markets

- lack of knowledge,
- distrust in collaboration (ie cooperatives),
- small farms (economies of scale)
- bottom-up governance



Thank You