UF IFAS
UNIVERSITY of FLORIDA

Soil Compaction and Amendments for Turf Health

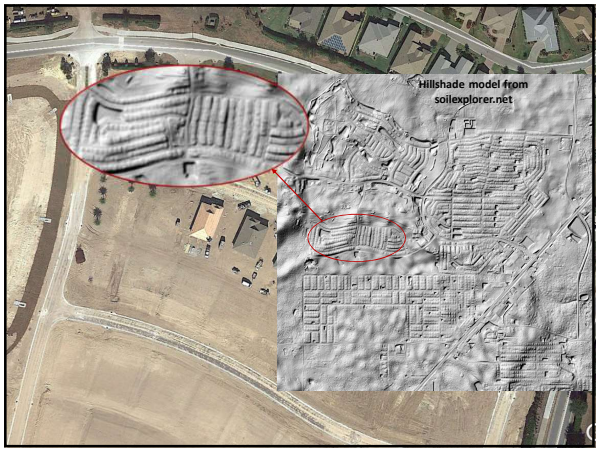
October 16, 2018

2018 Master Gardener Turfgrass Field Day

FOR THE
#GATORGOOD

Eban Bean[1], Allan Bacon[2], & Victoria Steinnecker[3]
[1]Assistant Professor & Extension Specialist, Agricultural & Biological Engineering
[2]Assistant Professor, Soil & Water Sciences
[3]Undergraduate Research Assistant, Agricultural & Biological Engineering

Landscape Development Process

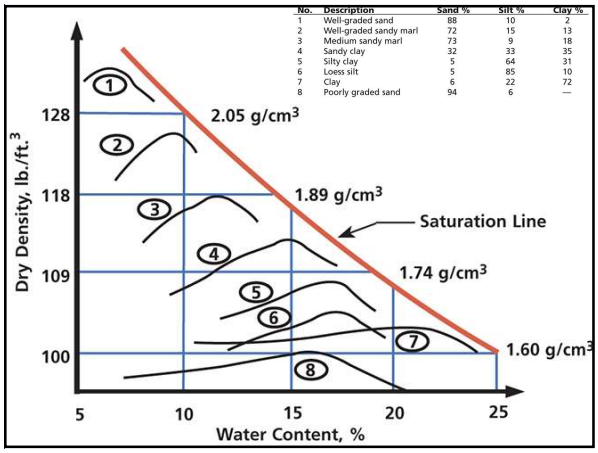


Landscape Traffic

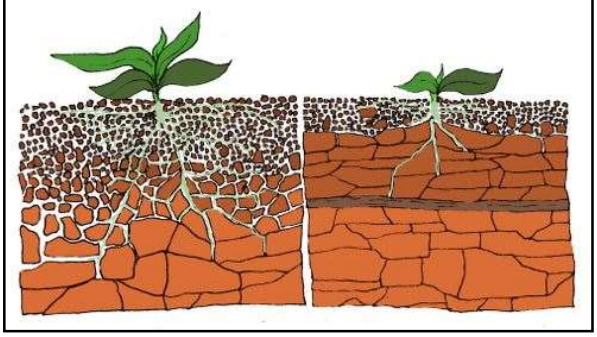
Home Building Process: 90-120 Days to construct a home

90-120 days of:

- Heavy vehicle traffic
- Wetting and Drying
- Vehicle vibration

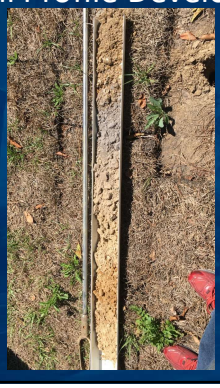


Soil Compaction



Make me a lawn!

Soil Profile Development



Compaction Mitigation Study

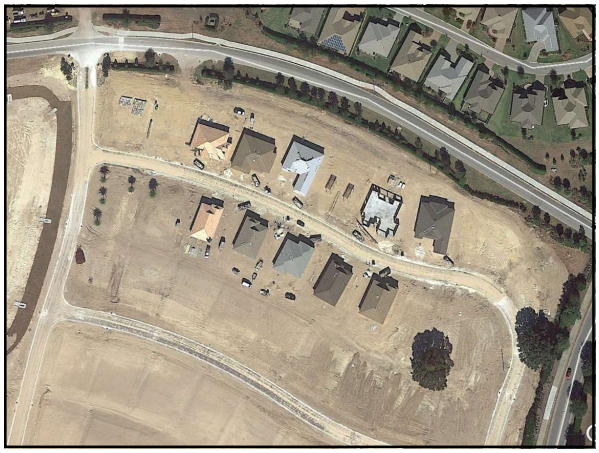
5,000 homes -> Buildout of 30,000 homes

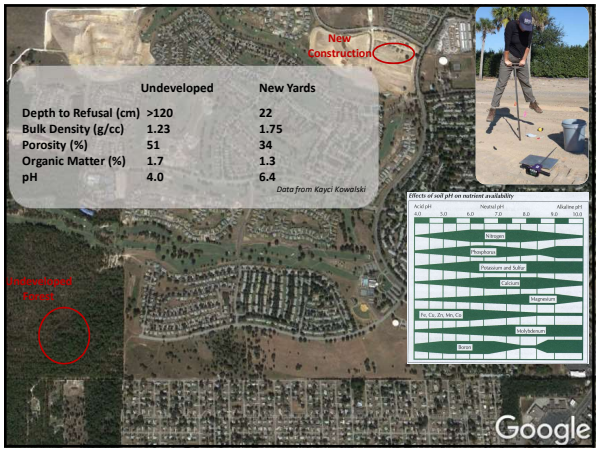
Active Adult Community – Marion, CO.

Average: 250 gal./home/day

OTOW: 190 g/h/d (CUP: 150 g/h/d)

January 2017 – January 2019

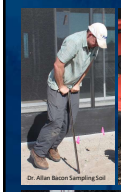


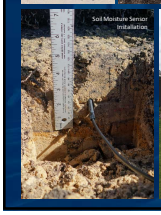


	Undeveloped	New Yards
Depth to Refusal (cm)	>120	22
Bulk Density (g/cc)	1.23	1.75
Porosity (%)	51	34
Organic Matter (%)	1.7	1.3
pH	4.0	6.4

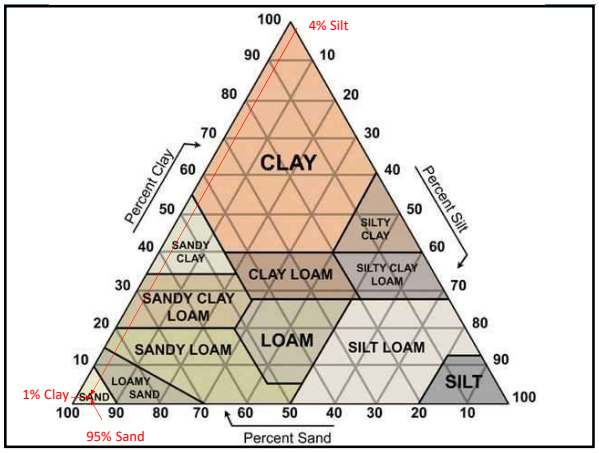
Data from Kayci Kowalski

On Top of the World





- Can compaction mitigation improve water availability for turfgrass?
- Monitoring/Sampling:
  - Soil Moisture
  - On-site Weathers Station
  - High Frequency Water Use
  - Soils Properties
  - Turfgrass Biomass
  - 'Green-ness'



Cone Penetrometer Measurements

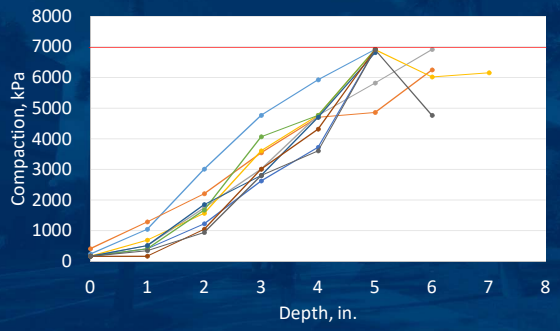
Measures Pressure for Cone Penetrating Soil Profile

Maximum Pressure is 7,000+ kPa
(~200 lbs. over cone area)

Maximum Depth: 45 cm (18 in.)

Profiles collected
Baseline & Post-Treatment

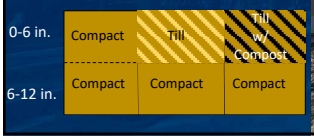
Soil Compaction Profiles

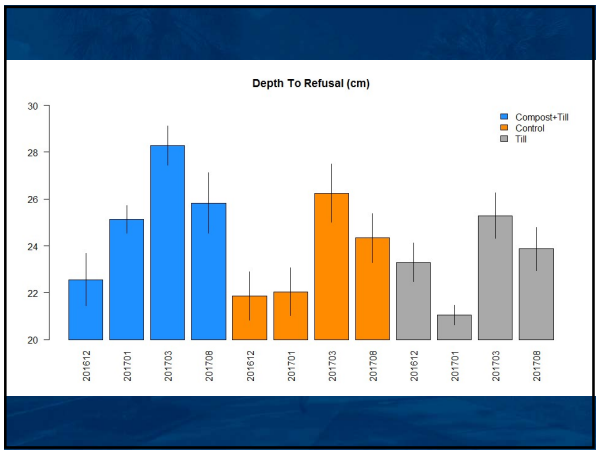


Treatments

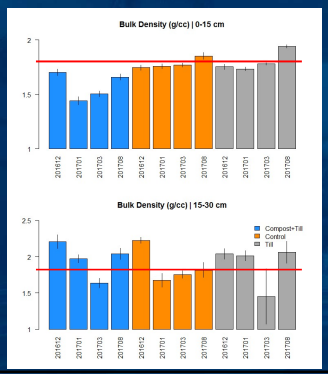
9 Model Homes
- 3 compacted
- 3 tilled (5-6 in.)
- 3 tilled compost into soil
  4 $yd^3/1000\ ft^2$
  (1 in. into 6 in.)

Just before sod laid

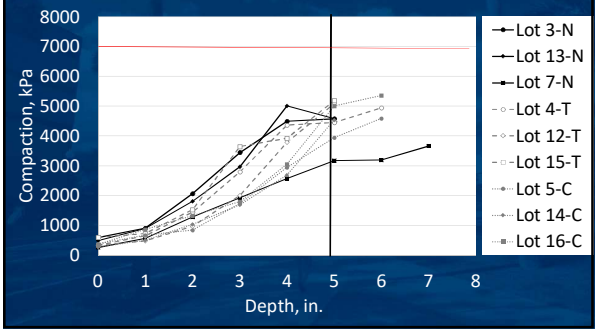




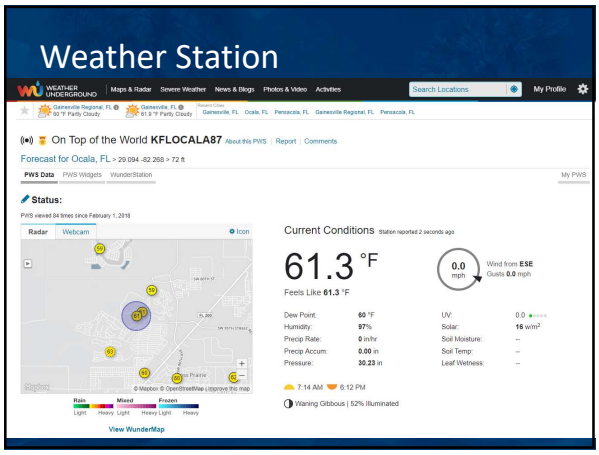
Bulk Density



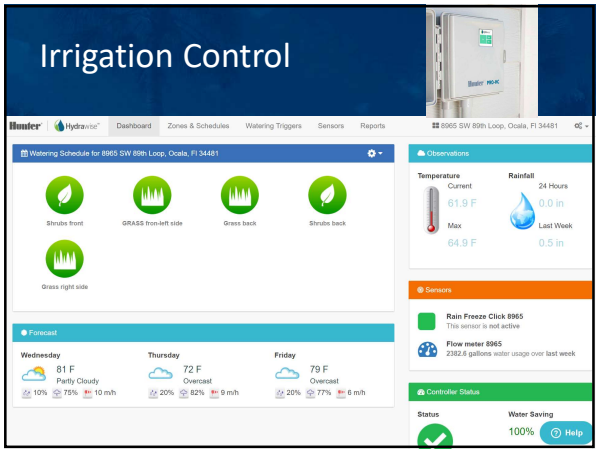
Cone Penetrometer Profiles Post-Treatments

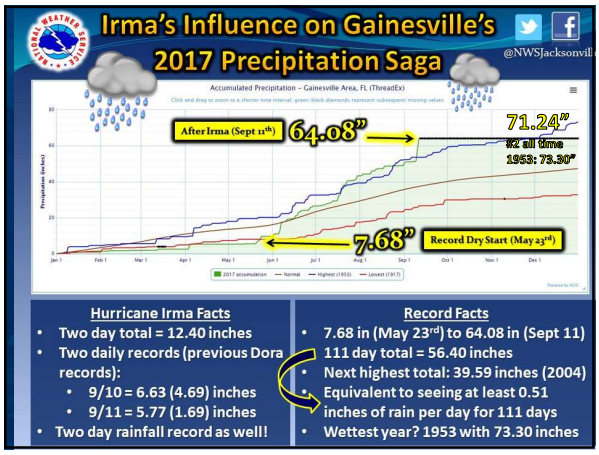


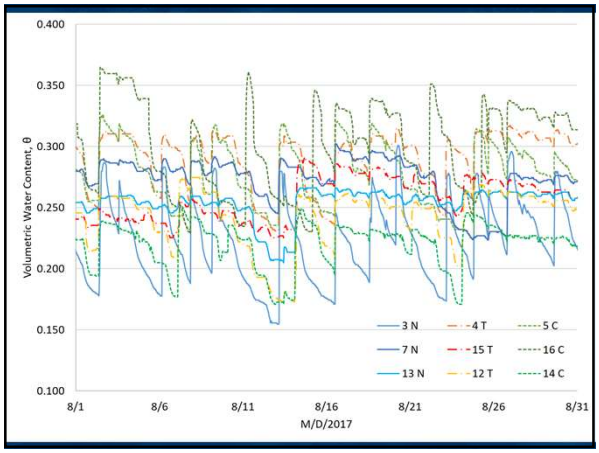
Weather Station



Irrigation Control



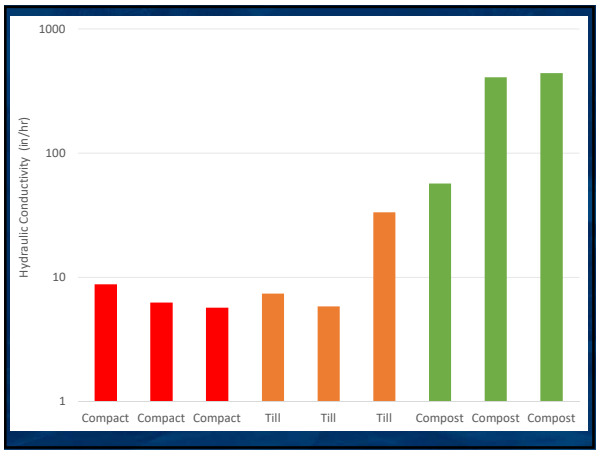


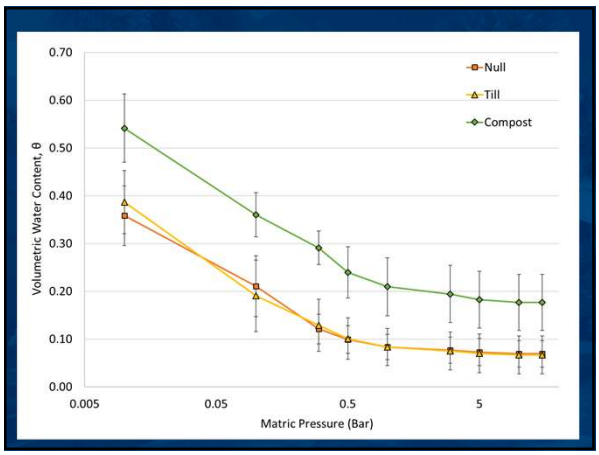


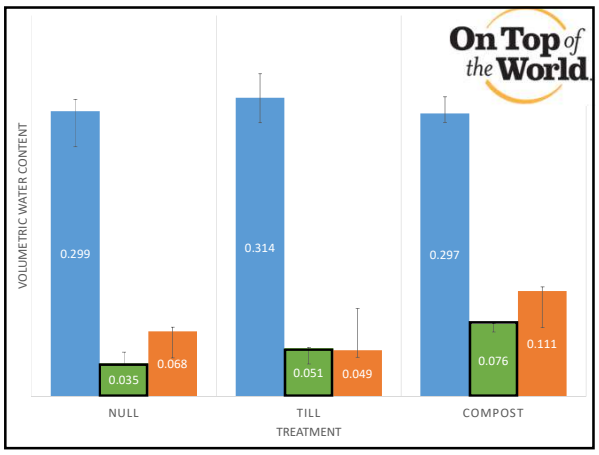
Infiltration Rates

- Constant Head Double Ring Infiltrometer Method (ASTM D3385)
- Conducted during April and May

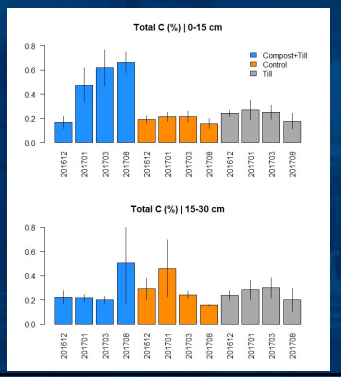
Compacted (Null) in./h		Tilled in./h		Till & Compost in./h	
Lot 3	0.15	Lot 4	1.50	Lot 5	0.57
Lot 13	0.09	Lot 12	0.25	Lot 14	0.08
Lot 7	< 0.04	Lot 15	< 0.06	Lot 16	0.22


1000
100
10
1
Hydraulic Conductivity (in/hr)
Compact
Compact
Compact
Till
Till
Till
Compost
Compost
Compost

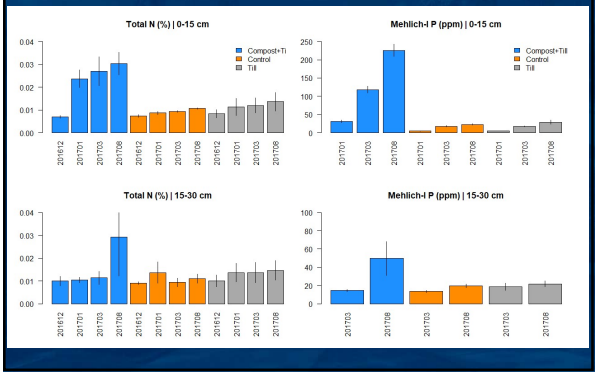

0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Volumetric Water Content, θ
Null
Till
Compost
0.005
0.05
0.5
5
Matric Pressure (Bar)


On Top of the World
VOLUMETRIC WATER CONTENT
0.299
0.035
0.068
0.314
0.051
0.049
0.297
0.076
0.111
NULL
TILL
COMPOST
TREATMENT

Soil Carbon



Nutrients

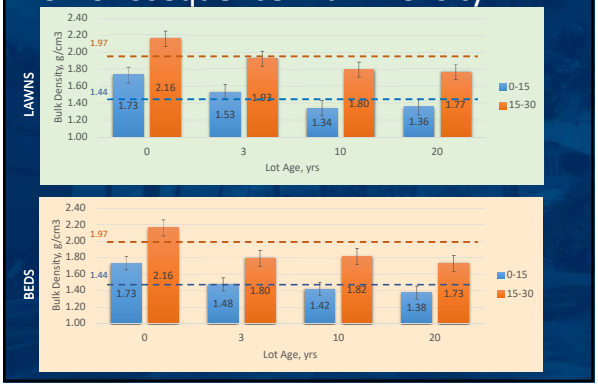


Turf Quality – September 17, 2017

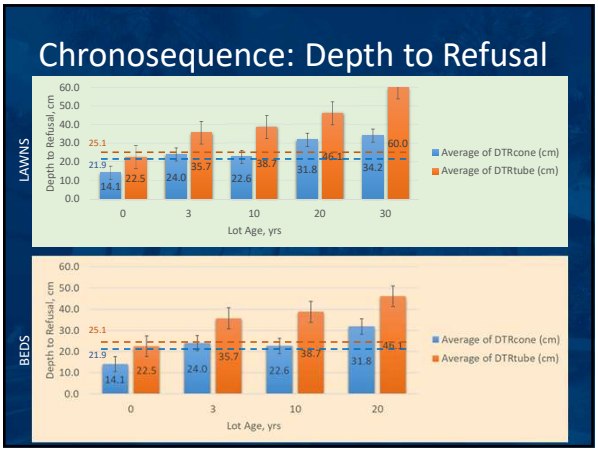
Chronosequence

Funded by FNGLA Endowed Research Fund Award

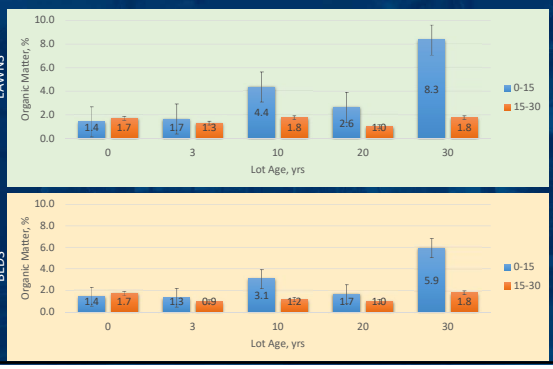
Chronosequence: Bulk Density



Chronosequence: Depth to Refusal



Chronosequence: Organic Matter



OTOW – Real World

BLUE: Compost
GREEN: Tillage
ORANGE: Control

Thick Lines: Complete

Dashed Lines: Almost complete

Thin Lines: No construction begun

Increase Landscape Function

Stream Mechanics, 2014

GEOLOGY ⇧ ⇧ CLIMATE

Acknowledgements

UF Collaborators:

- Jason Kruse, Env. Hort.
- Adam Dale, Entomology
- Sunny Liao, Soil & Water Science
- Basil Iannone, SFRC
- Lloyd Singleton, IFAS Extension
- Mary Lusk, IFAS Water RSA
- Pierce Jones, IFAS PREC
- Jim Fletcher, IFAS Water RSA

Partners

- Phillip Hisey, OToW
- Ryan McMeekin, LifeSoils
- Darren Midlane, HarvestQuest
- Bryan Schmalz, Bay Laurel Water Utility
- David Gruber, Earthscapes Unlimited

Questions?

Eban Z. Bean, Ph.D., P.E.
Assistant Professor & Extension Specialist
Urban Water Resources Engineering

ezbean@ufl.edu
EbanBean

AGRICULTURAL & BIOLOGICAL ENGINEERING

UF IFAS UNIVERSITY of FLORIDA

Center for LANDSCAPE Conservation & Ecology