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Landscape design strategies for sustainable biomass feedstock supplies

Douglas L. Karlen

USDA ARS-National Laboratory for Agriculture and the Environment, USA

Sustainable bioenergy production requires abundant, reliable, and clean (low ash or soil contaminated) feedstocks. Potential cellulosic sources include crop residues (e.g., corn stover, small grain or sugarcane straw) and energy crops (e.g., switchgrass or miscanthus). Environmental, economic, and social sustainability are our focal point because plant biomass also supports critical ecosystem services including building and maintaining soil health. Our project team is striving to quantify sustainable crop residue harvest and energy crop production goals for different soil resources and landscape positions. We are examining seed, fertilizer, water, herbicide, labor, machinery costs and many other metrics through simulation modeling and on-farm field research. It is important to recognize that agricultural biomass (perennial energy crops and crop residues) can be used to produce liquid fuels, chemicals, and heat/power. Direct comparisons to the wind and solar energy production would only be partially relevant. Our primary (targeted) end users are producers of liquid biofuels. For that purpose, one ton of agricultural biomass will produce about 70 gallons of ethanol. If used for heating, one ton of agricultural biomass will produce about 14 million Btu. If used for power generation in an efficient production facility, one ton of agricultural biomass can yield approximately 1,250 kWh of electricity. Currently, perennial energy crops can yield between 3 and 8 tons (or more) per acre depending on plant species and field conditions. Although land-use issues are an important component associated with biomass energy production, this project is pursuing an innovative strategy for identifying less profitable areas within current crop production fields and targeting them for energy crops. Our goal is to provide a land base for energy crops that do not infringe on highly productive agricultural lands, thereby simultaneously increasing both land-owner and environmental benefits (i.e., better soil health) on lands currently having negative environmental impacts due to soil erosion, nutrient leaching, loss of soil organic carbon, or emission of greenhouse gases. Examples of soil health measurements on row-crop versus perennial Conservation Reserve Program (CRP) land, using physical, chemical, and biological indicators, and being interpreted with the Soil Management Assessment Framework (SMAF) will be discussed.

Biography

Dr. Douglas L. Karlen is a Distinguished Senior Research Soil Scientist with the USDA-ARS at the National Laboratory for Agriculture and the Environment (NLAE) in Ames, IA. His research on soil quality assessment and sustainable bioenergy/bio-product feedstock harvesting is recognized internationally. He is author or co-author of 235 journal articles and more than 150 other publications. Doug is a Fellow of the American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, Soil and Water Conservation Society, and recipient of the Hugh Hammond Bennett award for national and international leadership in natural resources conservation.

Doug.Karlen@ars.usda.gov

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