

Problem Area 1. **Develop Beneficial Uses of Agricultural, Industrial, and Municipal Byproducts**

Problem Statement

Rationale. Agricultural, municipal, and industrial processes result in a wide array of byproducts. Many of these byproducts, if properly processed and used, may have specific benefits to water quality, soil quality, plant health, plant and animal production systems, and to reduce undesirable air emissions. In order to achieve these benefits, the byproducts need to be utilized in an environmentally sound manner that reduces the cost of disposal or converts them into marketable assets. While previous ARS research has resulted in acceptance of byproducts (i.e. foundry sand), there are many materials and applications for which little scientific information exists or potential benefits have yet to be identified.

Research needs. Technologically sound methods are needed for utilizing byproducts that will be characterized as beneficial. This includes blending, composting, and amending byproducts as well as developing land application and management techniques that will improve soil, water, and air quality in addition to improved plant growth. Specific sub-areas of research include development of application technologies, measurement of fate and transport of byproduct components, measurement of treatment efficacy and controlling processes, identification of beneficial properties, and cost-benefit evaluations. The overall objective is to utilize agricultural, municipal, and industrial byproducts in a cost-effective and environmentally sound manner.

Byproducts Problem Area 1. **Develop Beneficial Uses of Agricultural, Industrial, and Municipal Byproducts**

Inputs/Resources	Outputs/Products	Outcomes
<p>Location Contribution: Auburn, AL Beltsville, MD Bowling Green, KY Clay Center, NE Florence, SC Madison, WI Miss. State, MS Oxford, MS Watkinsville, GA West Lafayette, IN</p> <p>Cooperators National Council for Air and Stream Improvement Inc. (NCASI), Livestock Integrators NPRI, Coal Ash Association, Commodity Assn., agribusiness, university scientists, state soil and water conservation commissions, conservation tillage alliances, state and local regulators.</p>	<p>New and improved systems to capture, concentrate, and reuse nutrients from manures and other byproducts. Guidelines for using byproducts to stabilize or sequester nutrients in manures and soils. Procedures to use manure, compost, and byproducts to remediate and improve soils and to formulate manufactured soils. Knowledge of the effects of manure and byproducts to promote plant health and product quality. Product Users: byproduct generators, and producers (farmers and land managers); regulators (U.S. and state EPAs), action agencies (Army Corps of Engineers, NRCS, SWCD),</p>	<p>Long-term: Procedures will be used to evaluate, process, and apply byproducts for benefit. Short-term: Byproducts will be used for improvement of soil and the environment, remediation of degraded or contaminated soils. Byproducts will be used as components of manufactured soils.</p>

Problem Area 2. Develop Risk Assessments Trace Elements and Xenobiotics in Byproducts for Beneficial Uses in Agriculture and Horticulture

Problem Statement

Rationale. Each year in the U.S., millions of tons of agricultural, industrial and municipal byproducts are generated. Alternative uses for these byproducts are needed to promote sustainable agriculture as well as to reduce landfill space requirements, greenhouse gas emissions, and disposal/remediation costs. Many of these byproducts have characteristics that make them prospectively useful as soil amendments whether for direct land application, soil reclamation and remediation, or as components of manufactured soils and composts. US-EPA is actively encouraging Industrial Materials Recycling, with regulations adopted at the State level. At this time, state regulatory agencies lack evaluation tools for environmental acceptability of beneficial use of these byproducts in agriculture or horticulture. The ARS will conduct research to provide critical information about constituent phyto- and bio-availability in byproduct amendments to state regulatory agencies, and how to use these data to conduct pathway risk assessments to support use decisions.

Research needs. Many regulators are reluctant to approve land application, soil manufacturing and other agricultural and horticultural uses of byproducts because of a lack of knowledge of interactions with soil, nutrient bioavailability, groundwater impacts, and impacts on other soil-related functions and processes. The development of methods to examine and approve byproducts based on sound science will simultaneously ensure environmental protection, improve soil, water and air quality, and derive economic benefits to both byproduct generators and the agricultural community. Accurate and cost-effective methods of byproduct evaluation must be established. The specific research goals are to (1) identify agricultural, municipal, and industrial byproducts amenable to beneficial use in agriculture and horticulture; (2) develop a generic framework by which risks of byproducts of different origin and constituents can be evaluated; (3) identify analytical methods that can accurately identify and quantify byproduct risks from constituents using proper QA/QC; (4) develop a Decision Tree to help stakeholders determine which evaluation methodologies are appropriate for matching byproducts with intended uses--then develop a “branching” evaluation protocol that proposes analyses that could ultimately be carried out in independent laboratories and universities; and (5) characterize a number of different byproducts (including variability) using the generic framework to demonstrate to stakeholders that the proposed framework yields comparable and reproducible data.

Byproducts Problem Area 2. Develop Risk Assessments for Beneficial Uses in Agriculture and Horticulture

Inputs/Resources	Outputs/Products	Outcomes
Location Contribution: Auburn,AL Beltsville, MD Bowling Green, KY Clay Center, NE Florence, SC Cooperators Foundry Industry Recycling Starts Today (FIRST), EPRI, USEPA, US-FDA, State Regulatory agencies, universities, farming community, ASTM, National Council on Air and Stream Improvement, GLBMA, American Coal Ash Assn.	Generic test models or analyses. Decision trees for state, city, or local agencies. Guidelines on beneficial uses. Product Users State regulators and local permitting agencies.	Short-term Sampling, analysis, and assessment protocols for byproducts. Long-term A model process by which different types of byproducts can be evaluated for use in agriculture and horticulture. Development of generic evaluation methods for potential land applications.