Virtually every American has some knowledge of Flight 93, and most know that the crash site has been designated as a National Memorial to be developed and managed by the National Park Service. Few, however, know that the plane crashed on several hundred acres of poorly-reclaimed surface mined land. This reality presented new and difficult challenges given that the design by Paul Murdoch Architects and Nelson Byrd Woltz Landscape Architects for the memorial (selected by the Park Service) was highly tree-based. Project success will ultimately require survival and healthy growth of a diverse collection of native tree species in a highly compacted soil medium containing little organic matter and insufficient nutrients for normal tree growth.

Based on current soils research and 30 years of research at Virginia Tech, "how-to" guidelines called a Forestry Reclamation Approach have been developed for restoring the diversity and productivity of the native Appalachian forest on drastically disturbed mined land. These restoration principles, especially those pertaining to site preparation and amelioration have been incorporated into our design for the memorial. Initial performance of all biotic components of the design is promising despite the adverse initial site conditions we encountered.

This research and design overview of a large-scale soil remediation will summarize the knowledge gained from multiple phases over a number of years. It will also provide the bigger picture of reclamation processes in the eastern U.S. to restore native forests on surface mined land.

LEARNING OBJECTIVES

1. Present the design and construction process for the remediation of a former mine site into a national memorial.

2. Recognize the physical, chemical, and biological limitations of disturbed soils for native plants.

3. Describe the research-based restoration principles developed for restoring the native Appalachian forest on surface mined land.

4. Show how these proven forest restoration techniques were incorporated in project design that should ultimately result in a successful tree-based project.
PRESENTATION OUTLINE

I. Project Introduction: Design Overview

   A. Project Overview
      1. Project design
      2. Phasing of construction

   B. Perceived Challenges
      1. Past and current mining/reclamation practices
      2. Physical, chemical and biological limitations of mine soils and other
         disturbed soils
      3. Approaches for ameliorating compacted, infertile soils
      4. Examples of restored productivity and successful reforestation on
         mined land
      5. Limited species diversity in existing, invasive plants
      6. Construction Process
         a) Understanding existing soils and unknowns (cut/fill amounts)
         b) Site grading and compaction from heavy equipment
         c) Proper construction oversight to review testing, mixing, and soil
            installation.
         d) Project costs

   C. Design
      1. Control of exotic species
      2. Soil selection
      4. Planting techniques

   D. Construction
      1. Shortcomings
         a) Construction schedule
         b) Documentation of soil storage
         c) Unknown conditions (cut/fill)
         d) Complexity of soil design
         e) Soil mixing and testing challenges
         f) Plant installation practices
      2. Phase 1 Successes
         a) "Field of Honor" native meadow
         b) Raingardens
         c) Attendance and reviews
3. Lessons Learned
   a) Early involvement and education of all parties
   b) Simplification of planting design
   c) Simplification of soil design
   d) How to minimize costs, project budget

II. Restoring the native hardwood forest on mined land
   A. Current reclamation processes for surface coal mines in the eastern U.S.: Why and what is the problem.
   B. Physical, chemical, and biological limitations of mine soils for native trees.
   C. Approaches for ameliorating compacted, infertile mine soils covered with exotic species.
   D. Examples of successful reforestation of experimental and operational mine sites.
   E. Cultural legal, economic, and political constraints overcome for adopting forest restoration practices.

III. Designs for a tree-based project on mined land: Overcoming site physical, chemical, and biological constraints

IV. Revised designs for future phases of construction
   A. Revised Approach
      1. Applying research and lessons learned
         a) Ripping and decompaction of site soils
         b) Organic matter to support diverse soil biology
         c) Simplified design
      2. Benefits to communication, budgets, installers and project timing
FURTHER RESEARCH:

http://www.nps.gov/flni/
http://www.paulmurdocharchitects.com/project/flight-93-national-memorial
http://www.prp.cses.vt.edu/
http://www.prp.cses.vt.edu/Research_Results/Research_Result_Topics.html
http://www.arri.osmre.gov/

PRESENTERS

Paul Josey, PLA, ASLA, ISA
Nelson Byrd Woltz Landscape Architects

Paul is a landscape architect and Associate at Nelson Byrd Woltz with over 10 years of experience specializing in soil design, native plants and rainwater reuse on urban and institutional projects. He has lectured at the University of Virginia on the topic of soils in design, was a contributor to the book Up By Roots by James Urban and has worked on projects including Flight 93 National Memorial in Shanksville, Pennsylvania and Citygarden in St. Louis, Missouri. He is currently the project manager on the Southwest Waterfront in Washington, D.C. and Centennial Park in Nashville, Tennessee emphasizing long-term design for trees and people alike.

James Burger, Ph. D.,
Virginia Tech, Blacksburg

Jim is Professor Emeritus of Forestry and Soil Science in the Department of Forest Resources and Environmental Conservation at Virginia Tech where he taught and still does research on topics including mined land reclamation, forest soil quality, silviculture, and restoration ecology. He has been involved in land reclamation and reforestation research for 30+ years in the Appalachian coalfield region. He has published over 100 papers on original reclamation research and supervised the work of 42 graduate students whose theses dealt with soil quality questions. Jim has served as president of the American Society for Mining and Reclamation and he is a recipient of the Society’s William T. Plass Award for career-long contributions to reclamation science and practice. He actively consults with major mining companies on reclamation issues in the US and abroad.