Spray Advisor

USDA Forest Service
In cooperation with:
West Virginia University

Jackie Strager
Natural Resource Analysis Center
West Virginia University
Morgantown, WV

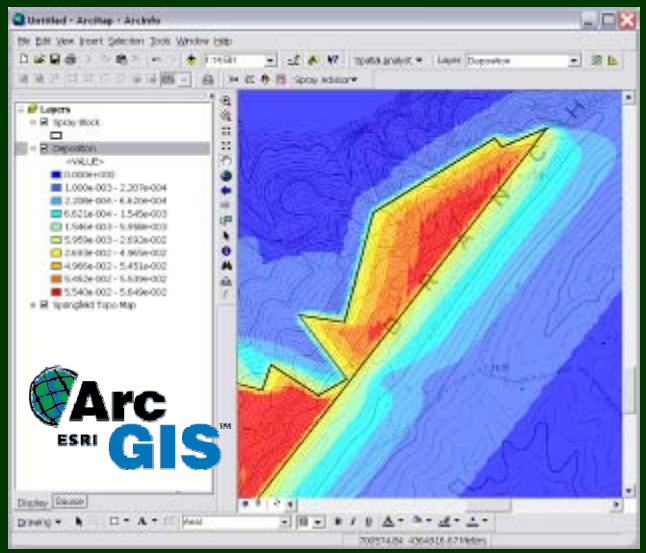
Photo: John Ghent, USDA Forest Service

Spray Advisor

- What is the Spray Advisor?
  - Set of decision support tools for aerial spraying
  - Incorporated within a GIS framework
  - Ongoing technical project coordinated by the USDA Forest Service

Project Objectives

- Coordinate technology development for aerial spraying and related decision support
- Develop spatially-based tools to aid spray program managers
- Make use of widely available GIS software



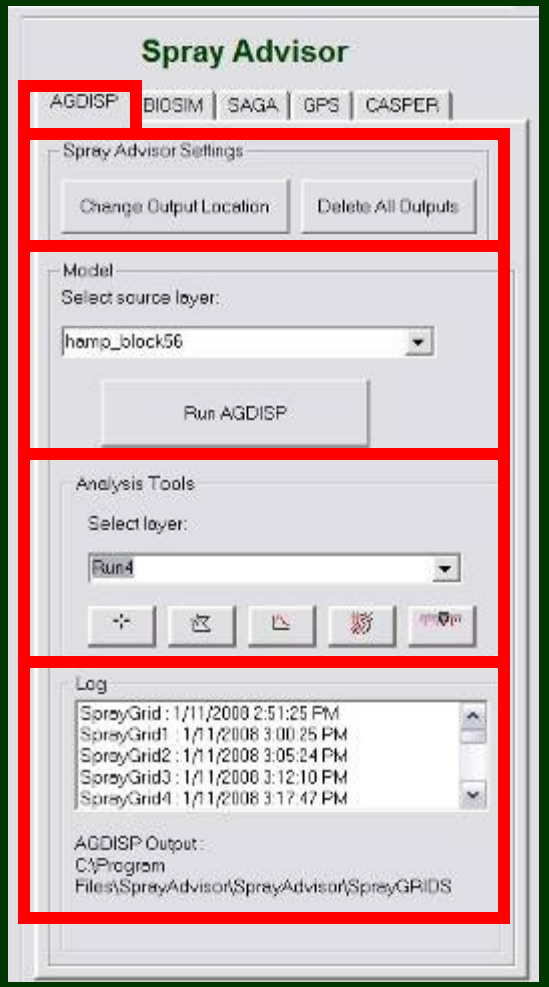
Using Spray Advisor

- Uses of Spray Advisor:
  - Planning spray programs
  - Training tool
  - Assessment of spray results
  - Mitigation of spray drift

- Requirements:
  - GIS software (ArcGIS 9.x)
  - GIS datasets
    - Spray block boundaries (pre-spray) *or*
    - Spray lines (post-spray)

Spray Advisor Tools

- Spray Advisor Extension
- Toolbar in ArcGIS version 9
- Current capabilities:
  - General settings and options
  - Spray deposit and drift modeling using AGDISP model
  - Several tools for analysis and query of modeled deposition and drift
  - Logging of model settings



AGDISP Model Input

- Inputs
  - Spray block boundary

    or
  - Spray lines (from GPS)

Spray Advisor
February 27, 2008

AGDISP Model

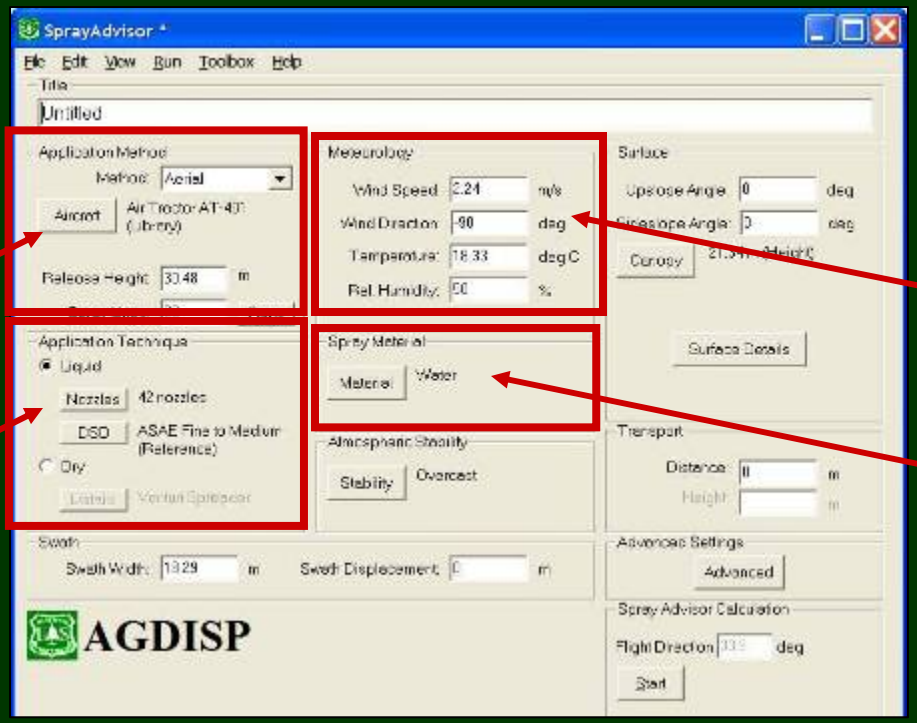
- Model to simulate and predict spray deposit and drift
- Dependent on:
  - Spray droplet sizes
  - Release height
  - Turbulence behind aircraft
  - Meteorological conditions
- Near-wake model, validated

Images: USDA Forest Service
Continuum Dynamics, Inc.

AGDISP Model

Spray Advisor and AGDISP:

- Utilizes full AGDISP computational engine



Aircraft

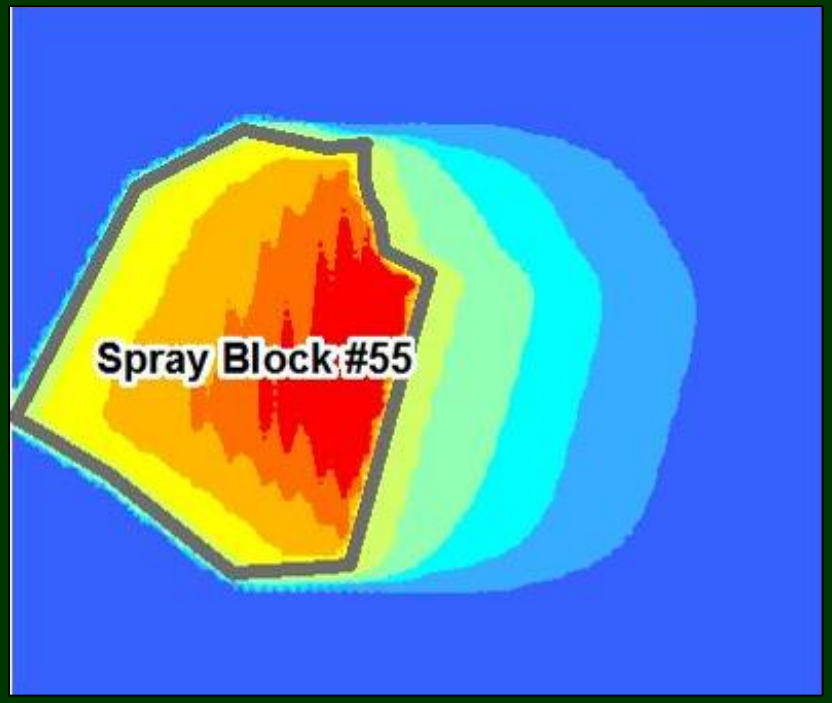
Application details

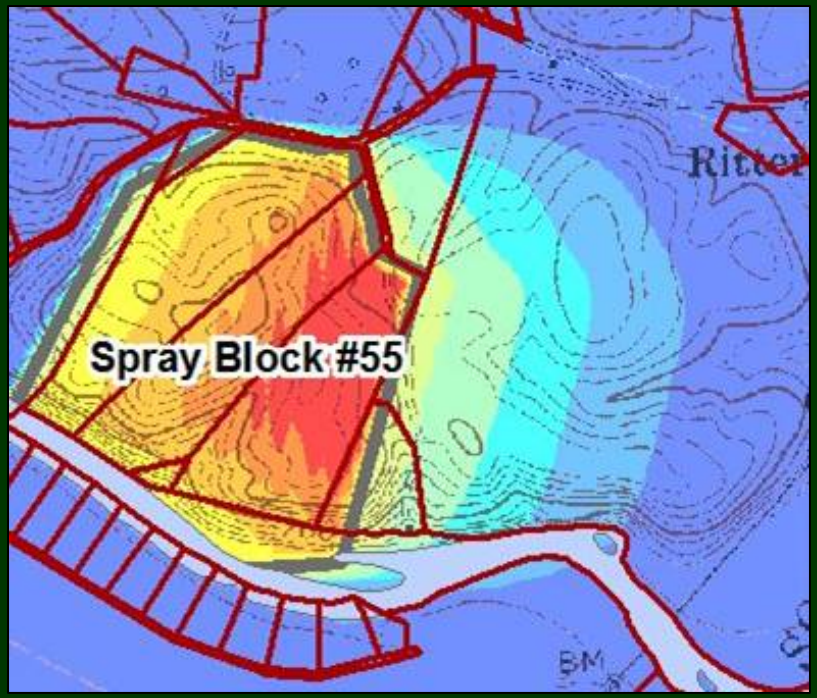
Meteorology

Spray material

AGDISP Model Output

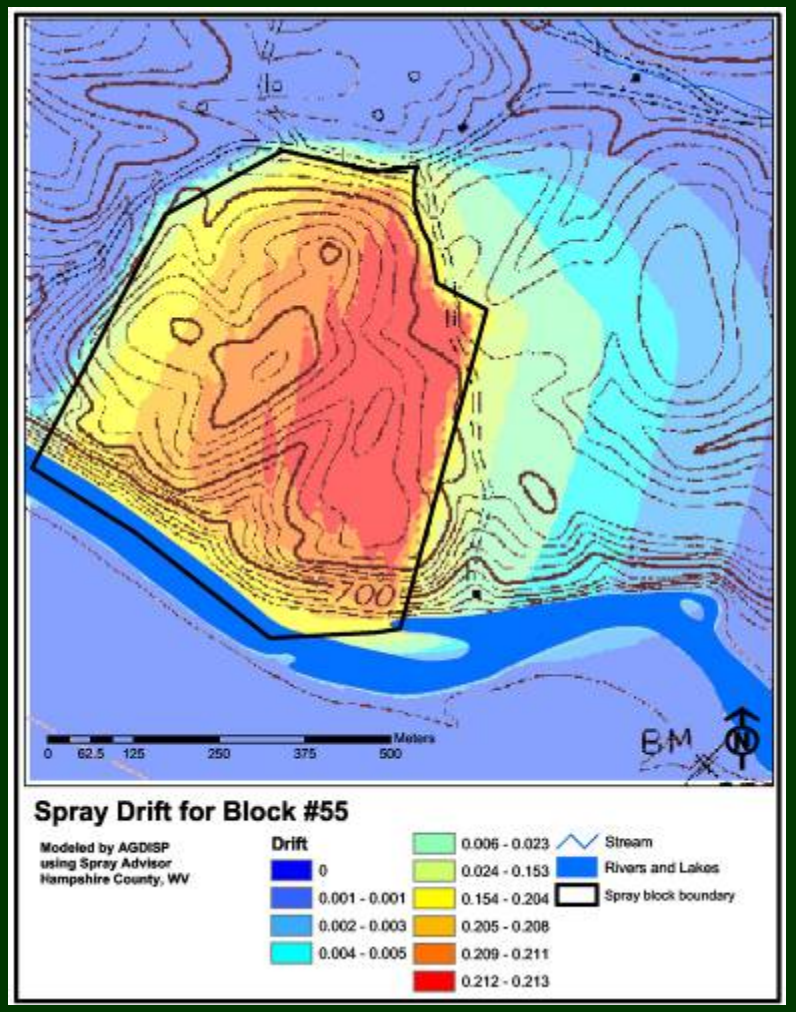
- Output
  - Downwind drift (deposition) as new layer in map





Using Spray Advisor

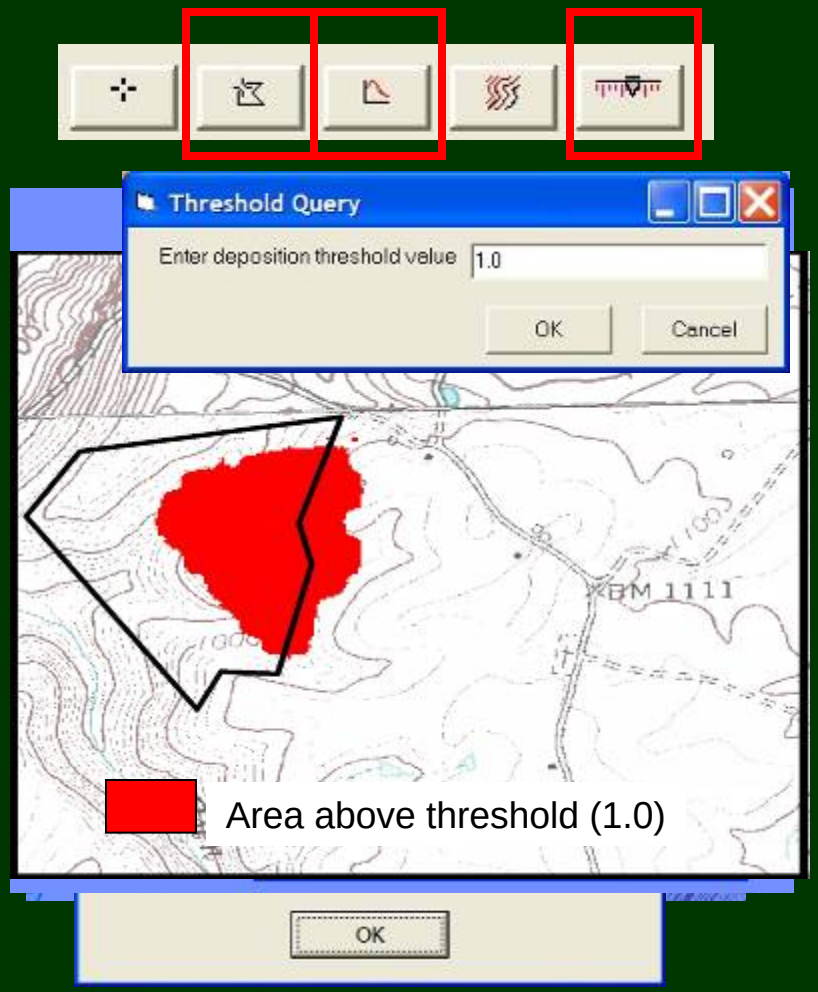
- Integration within ArcGIS allows drift model output to be used in many ways:
  - Visualization of results on map
  - Spatial overlay with other GIS datasets
  - Comparison of different model runs
  - Statistical summarization and analysis
  - Use other capabilities of ArcGIS



Tools

Tools to assess results:

- Query deposition at point
- Query deposition for area
- Deposition profile graph
- Deposition contours
- Query threshold values



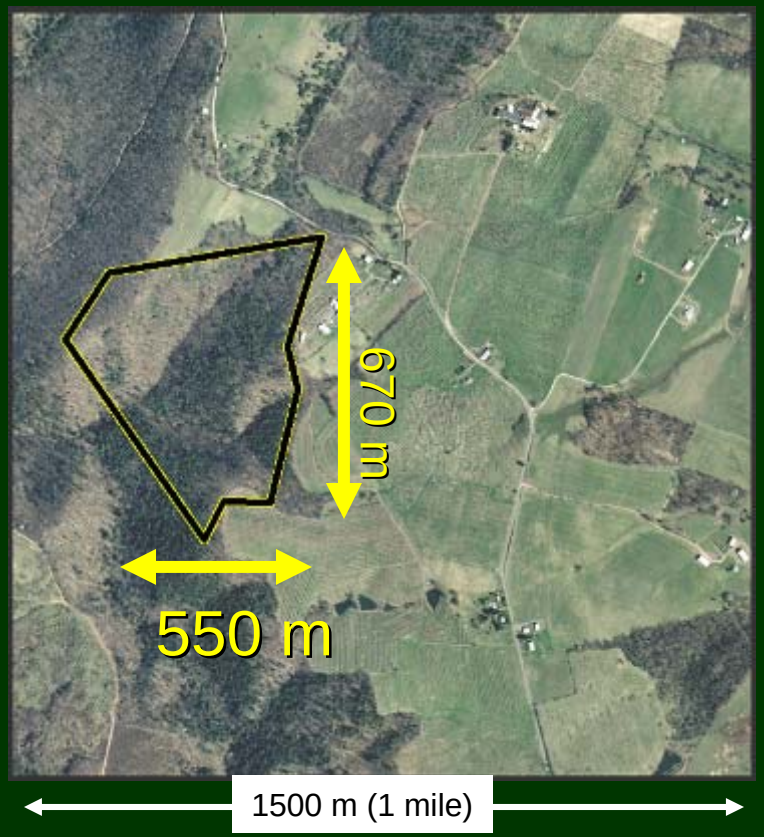
Demonstrations…

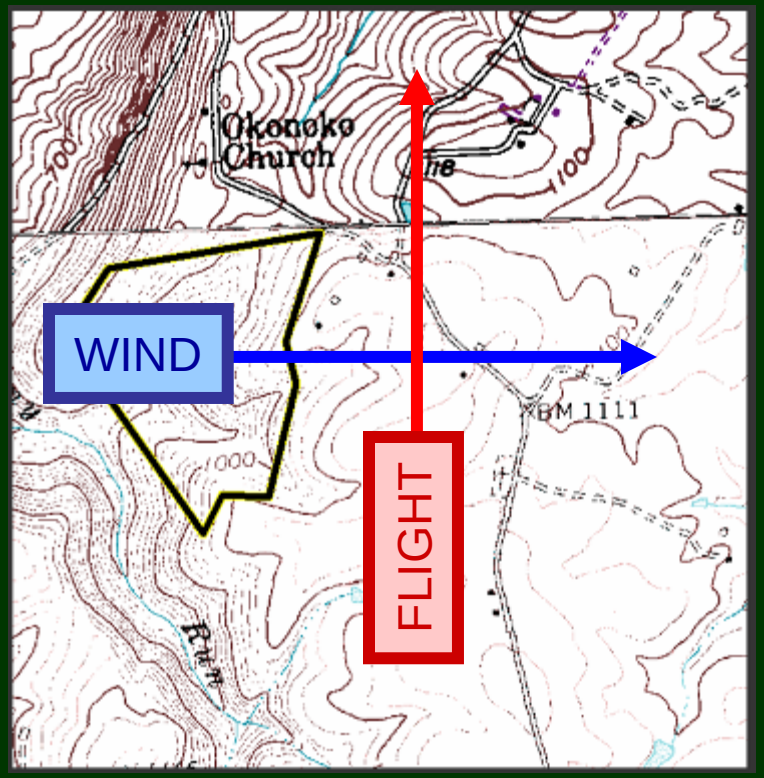
1. Sample results from AGDISP runs under multiple scenarios

2. Live demo available during interactive sessions 11:15-12:00

Input Dataset: Polygon

- Study site:
  - Block #56, Hampshire County, WV 2001
  - 50.2 acres in size





Input variables in AGDISP

Spray Scenario:

- Dimilin 4L at 0.5 oz/ai/ac at 0.5 gal/acre (180 µm droplets)
- Active Fraction (% ai in the tank mix) = 0.0078
- Nonvolatile fraction (amount of total spray that does *not* evaporate) = 0.1

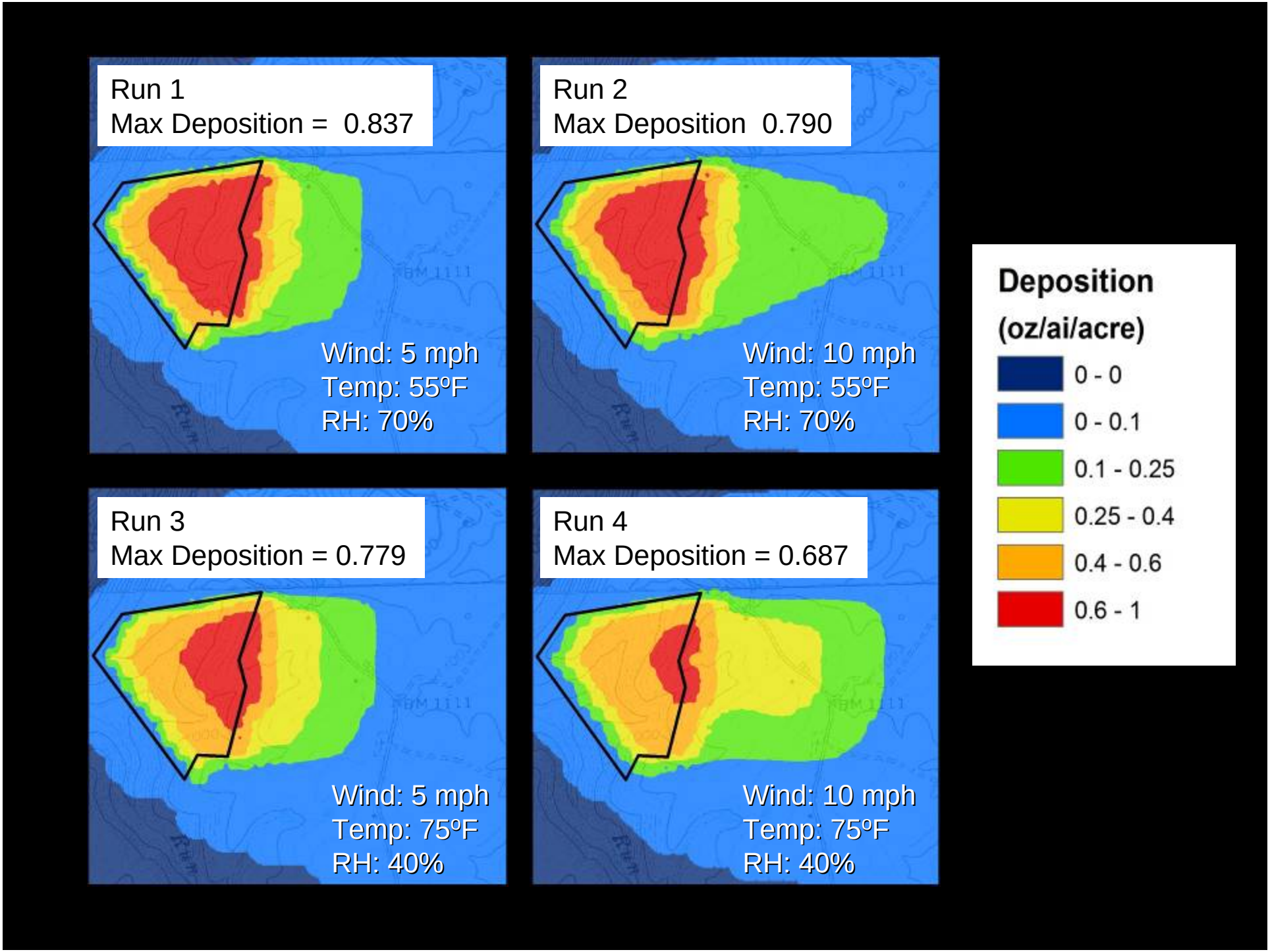
Settings:

- Canopy height: 70 ft
- Release height: 130 ft
- Aircraft: Air Tractor 502
- Swath Width: 150 ft
- Nozzles: n=6, 95% spacing
- Varied wind speeds, air temp, and relative humidity

Demonstration Runs

- Spray Material: Dimilin

Run #	Rate	Wind speed	Temp	Relative Humidity	Situation
1	0.5 gal/acre	5 mph	55˚ F	70%	Best
2	0.5 gal/acre	10 mph	55˚ F	70%	
3	0.5 gal/acre	5 mph	75˚ F	40%	
4	0.5 gal/acre	10 mph	75˚ F	40%	Not ideal


Run 1
Max Deposition = 0.837
Wind: 5 mph
Temp: 55ºF
RH: 70%
Run 2
Max Deposition 0.790
Wind: 10 mph
Temp: 55ºF
RH: 70%
Run 3
Max Deposition = 0.779
Wind: 5 mph
Temp: 75ºF
RH: 40%
Run 4
Max Deposition = 0.687
Wind: 10 mph
Temp: 75ºF
RH: 40%
Deposition
(oz/ai/acre)
0 - 0
0 - 0.1
0.1 - 0.25
0.25 - 0.4
0.4 - 0.6
0.6 - 1

Current Work

- Work with AGDISP results
  - Display results indicate areas of zero deposition
  - New custom contour creation tool

- Support for importing data from aircraft GPS:
  - Formats converted:
    - AG-NAV
    - Satloc
    - Trimble
  - Converts flight data into shapefile format

Future Plans

- Incorporate more complex spray scenarios
  - Multiple AGDISP inputs (e.g. varied meteorology)
  - More complex terrain, far-wake modeling
- Additional spray-related models and tools
  - BIOSIM insect phenology/efficacy
  - Computer Aided Spray Productivity and Efficiency Routine (CASPER)
  - Spray Advisor Genetic Algorithm (SAGA)
  - Dose-response modeling tools (Spray Safe Manager)

Acknowledgments

- Spray Advisor is a cooperative effort directed by the USDA Forest Service
- Major collaborators:

West Virginia University
Interface development, ArcGIS Spray Advisor extension development

Scion (Forest Research, New Zealand)
Programming support and design for dose-response and environmental modeling (Spray Safe Manager)

Continuum Dynamics, Inc.
AGDISP near-wake spray drift model

Canadian Forest Service
BIOSIM insect phenology and efficacy modeling

University of Georgia Artificial Intelligence Center
Spray Advisor Genetic Algorithm (SAGA)
Optimization of CASPER


UGA0796045