Seed and pollen dispersion and invasion from round-up resistance horseweed (Conyza canadensis)

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Introduction

- Horseweed is a problematic weed.
- Native in north/central America.
- Wide spread Glyphosate-Resistant (GR) biotype (reported in 16 US states).
- No-till systems (cotton, corn, soybean).
- Prolific seed producer (at the order of ~100,000 seeds /plant).
- Light-weighted seed/pollen, wind disposal.

Horseweed field in UIUC, 2013

Objectives of our project:

- Measure seed/pollen release in two experimental fields (IL and TN)
- Quantify seed/pollen dispersion distance
- Examine the relationships of seed/pollen release, dispersion with meteorological parameters.
- Apply the new findings into the existing atmospheric transport model and improve the performance of the model.
- Develop an online tool to predict the seed/pollen dispersal.

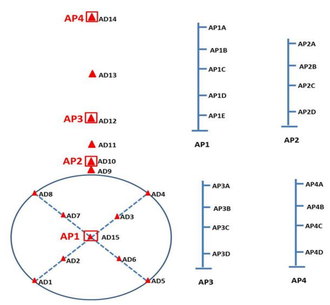
Experiment design

Four sites in UIUC (*Aug 2013 – Oct 2013*)

- Rotorod sampler and balloon
- Plant density: ~7-30 plants/m^2
- Plant height: ~1m-2m

One site in University of Tennessee (*Aug 2013 – Oct 2013*)

- Rotorod sampler
- Plant density: ~6 plants/m^2
- Plant height: ~1.3m



Schematic map for the field in TN

"Mystery balloons floating above city"

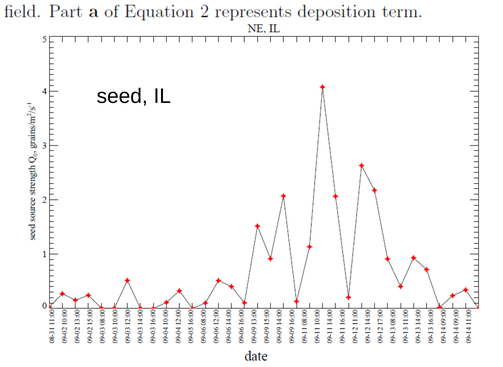
http://www.illinoishomepage.net/story/mystery-balloons-floating-above-city/d/story/YrvhXFrx80ClDbQaTRn7kw

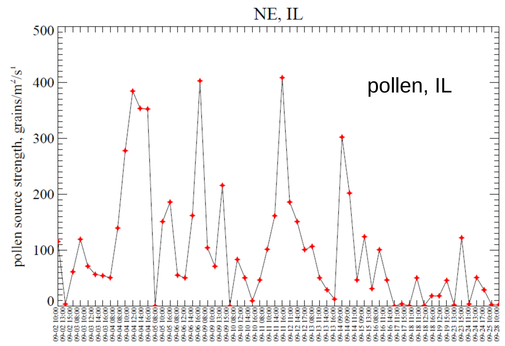
Results

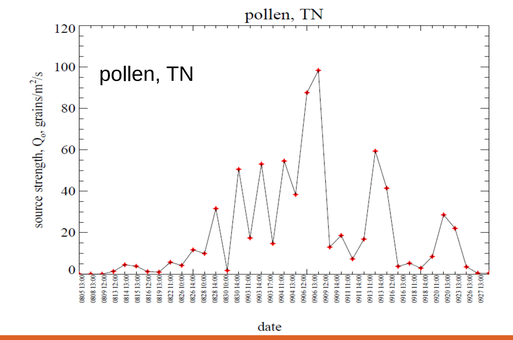
Source strength (release rate)

$$Q_0 = \underbrace{\frac{\int_0^R D(r)\,\mathrm{d}r}{R}}_{a} + \underbrace{\frac{\int_0^\infty u(z)C(0,z)\,\mathrm{d}z}{R}}_{b},$$

- Q_0: source strength (release rate) (grains/m^2/s)
- $D(r)$: deposition flux density (grains/m^2/s)
- r: distance from the field center along the wind direction,
- $u(z)$ (m/s): wind speed at height z (m),
- R: maximum distance between the field edge to the center of field along the wind direction,
- $C(0,z)$ (grains/m^3): concentration of pollen/seeds at the center of the field. Part **a** of Equation 2 represents deposition term.

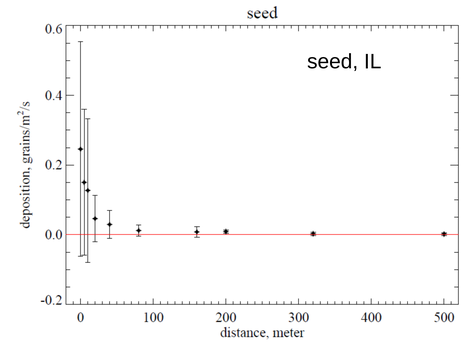


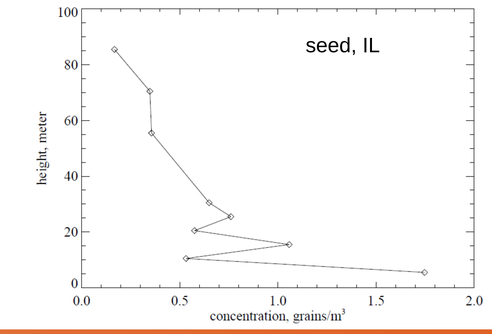




Results (2)

Horizontal and vertical distributions





Concluding remarks

We carried out two field experiments to measure the seed/pollen release from horseweed in IL and TN.
Substantial seed/pollen release were observed. Most of the seeds released were deposited within about 300m, while pollen could travel longer. Very few of seeds could reach the height above 40m.

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