Update on the Status of the Witchweed (*Striga asiatica*) Control Program in North Carolina

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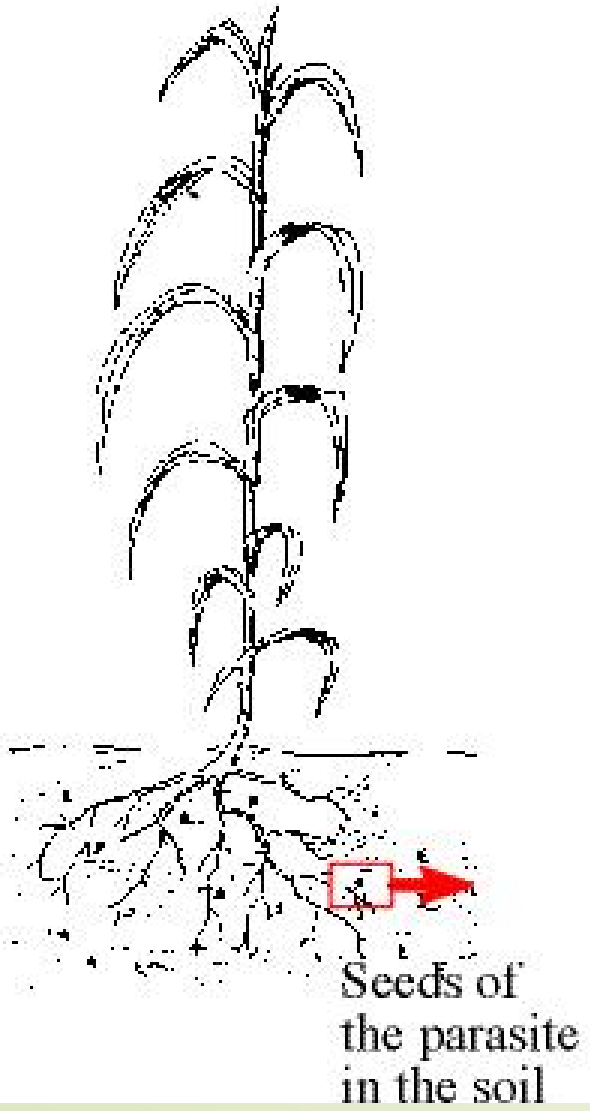
Life Cycle & Biology

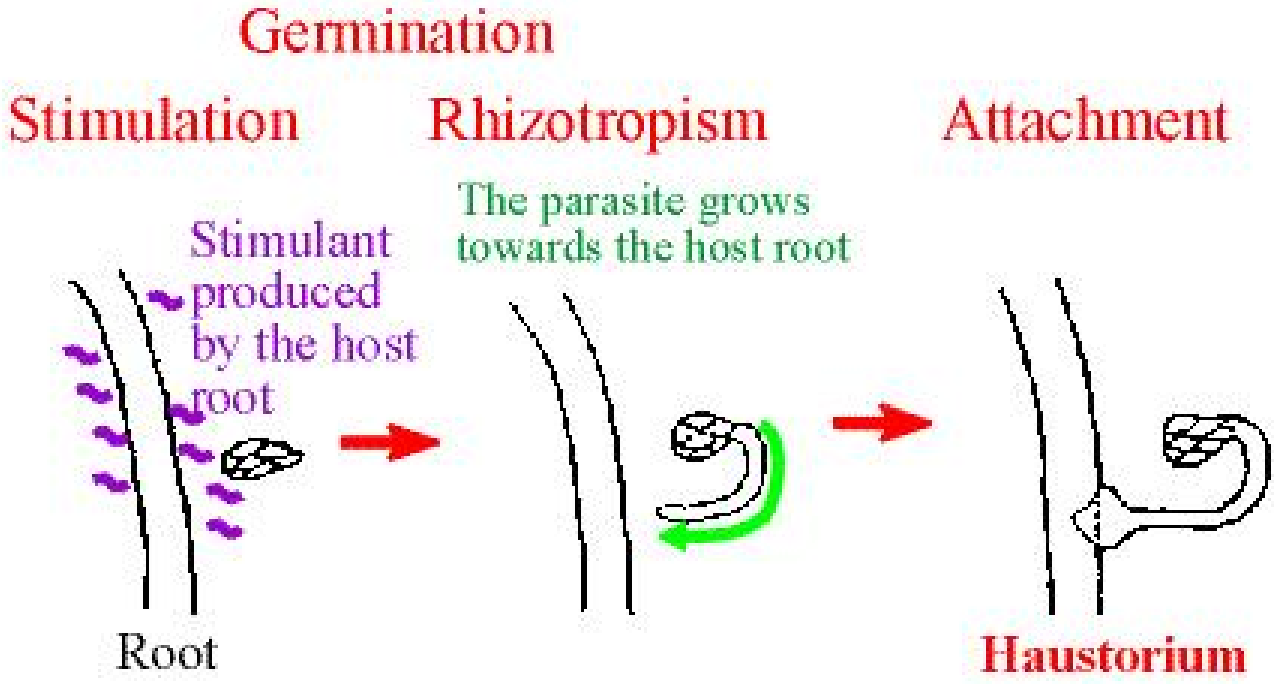
Striga species in crops

- Striga asiatica – North and South Carolina, USA
- Striga gesnerioides – West Africa, Florida??
- Striga hermonthica - Africa

Striga is an Obligate Parasite

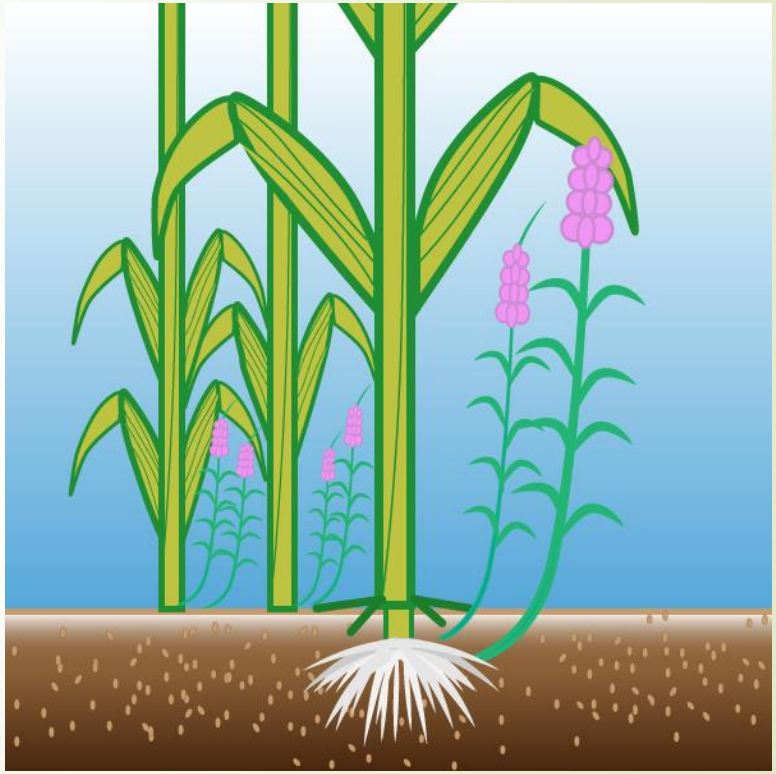


Underground development and early development stages of the parasite



Suitable Hosts

- Corn (*Zea mays*)
- Rice (*Oryza sativa*)
- Pearl Millet (*Pennisetum glaucum*)
- Many Grasses (*Poacea*)
- Sugarcane (*Saccharum officinarum*)
- Foxtail Millet (*Setaria italica*)
- Sorghum (*Sorghum bicolor*)
- Finger Millet (*Elusine coracana*)
- Ricegrass Paspalum (*Paspalum scrobiculatum*)



Reproduction

- *S. asiatica* reproduces by seed only.
- Many seeds produced on one plant.
- Seed longevity of at least 14 years has been recorded in South Africa and the USA.
- Seeds very small (0.5 mm)

Symptoms

Leaves

- Rolled or Folded
- Wilted
- Yellowed or dead

Stems

- Stunting or rosetting

Whole Plant

- Dwarfing
- Early senescence
- Reduced yield

Striga in Sorghum, NC, 2014

Requirements

Soils

- Sandy
- Infertile
- Dry
- Low nitrogen

Temperature

- High temperature (30-35° C) needed for seed germination
- Dormant seeds can survive freezing temperatures
- Photoperiod of up to 16 hours

Movement & Dispersal

Natural Dispersal

- Wind
- Rain

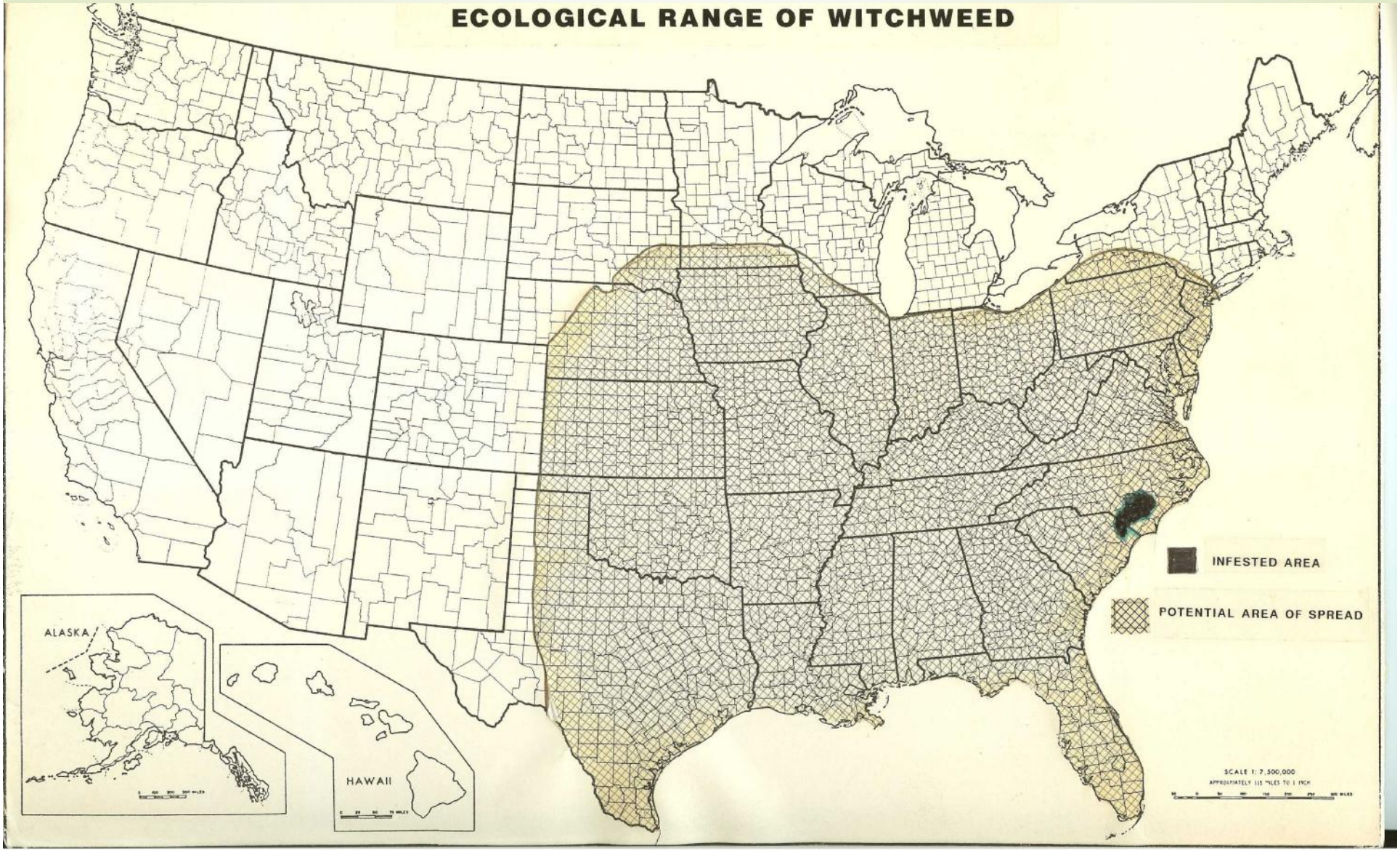
Vector Transmission

- Soil on feet (humans and animals)
- Ingested by livestock

Accidental Transmission

- Farm Equipment
- Root crops (sweet potatoes, peanuts)
- Forage for livestock
- Plant trade (bulbs, seedlings, seed)

Potential for Huge Impact in U.S.



Control Measures

Principles of Witchweed Eradication

1. *Find it…..*
2. *Prevent Reproduction and Spread…..*
3. *Exhaust the Seed Reserves in the Soil……..*

1. Survey and Detection

The Point System

- Fields are assigned points based on survey activity
- Infested fields - 0 to 5 points
- Released - 5 points
- Released fields continue to be surveyed. Assigned points over a 10 year period (1 point for a whole field survey; 0.5 points for spots)
- Terminated - 10 points

2. Prevent Reproduction & Spread

- Deny reproduction by use of herbicides or cultural practices
- Phytosanitary practices such as inspection of crops, spray down tractor tires with sterilant)

Regulatory

- Permits for regulated articles(straw)
- Treatment of regulated articles prior to movement (washing of equipment)
- Inspections (movement of hay)

3. Exhaust Seed in the Soil

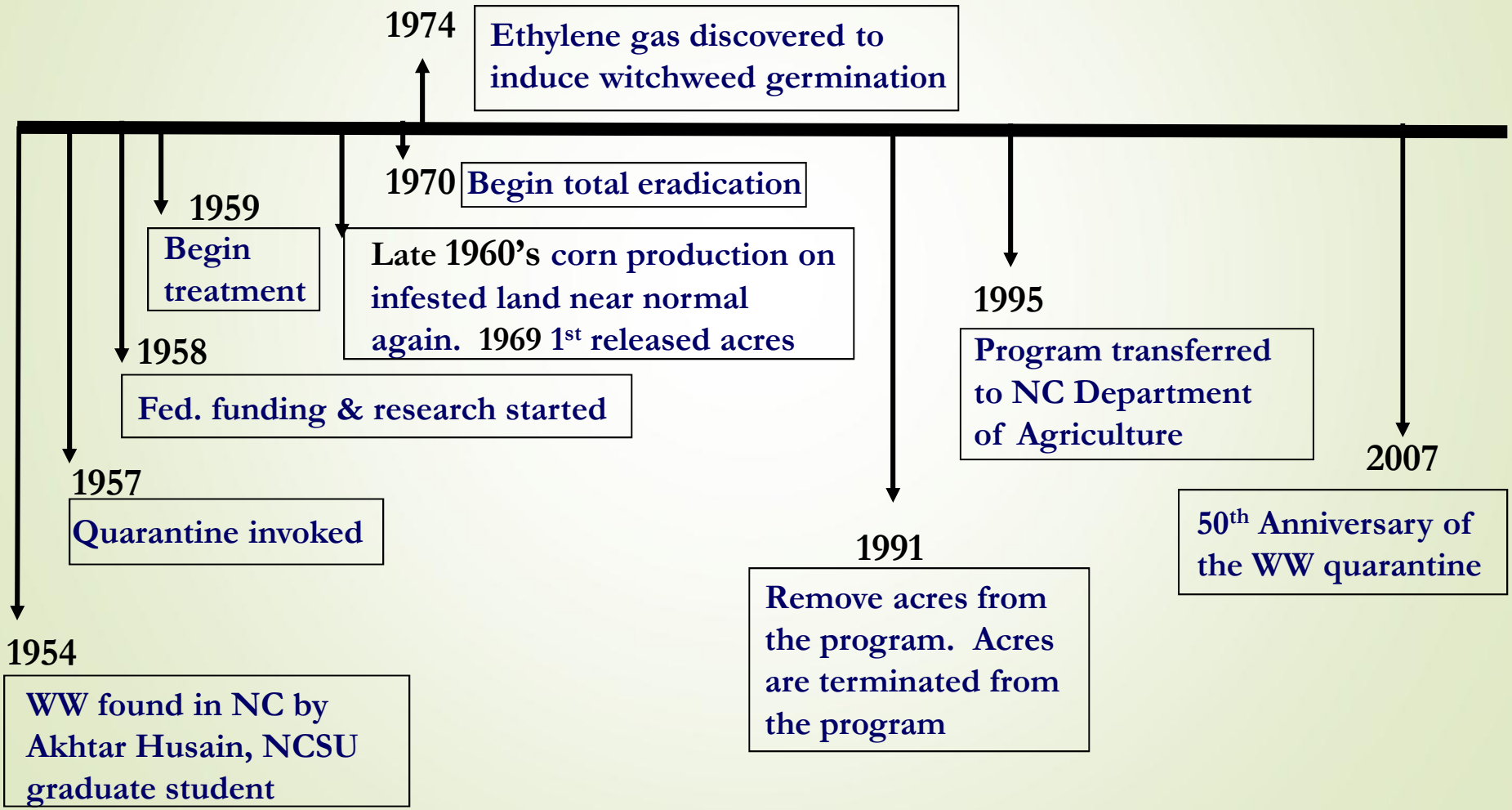
- Devitalize seed in soil
- Deplete seed in the soil by encouraging germination :
  - ethylene gas
  - host plants (crabgrass, johnsongrass)
  - false host plants (cotton)
  - Methyl Bromide (practice abandoned in 2010)

Ethylene Treatments

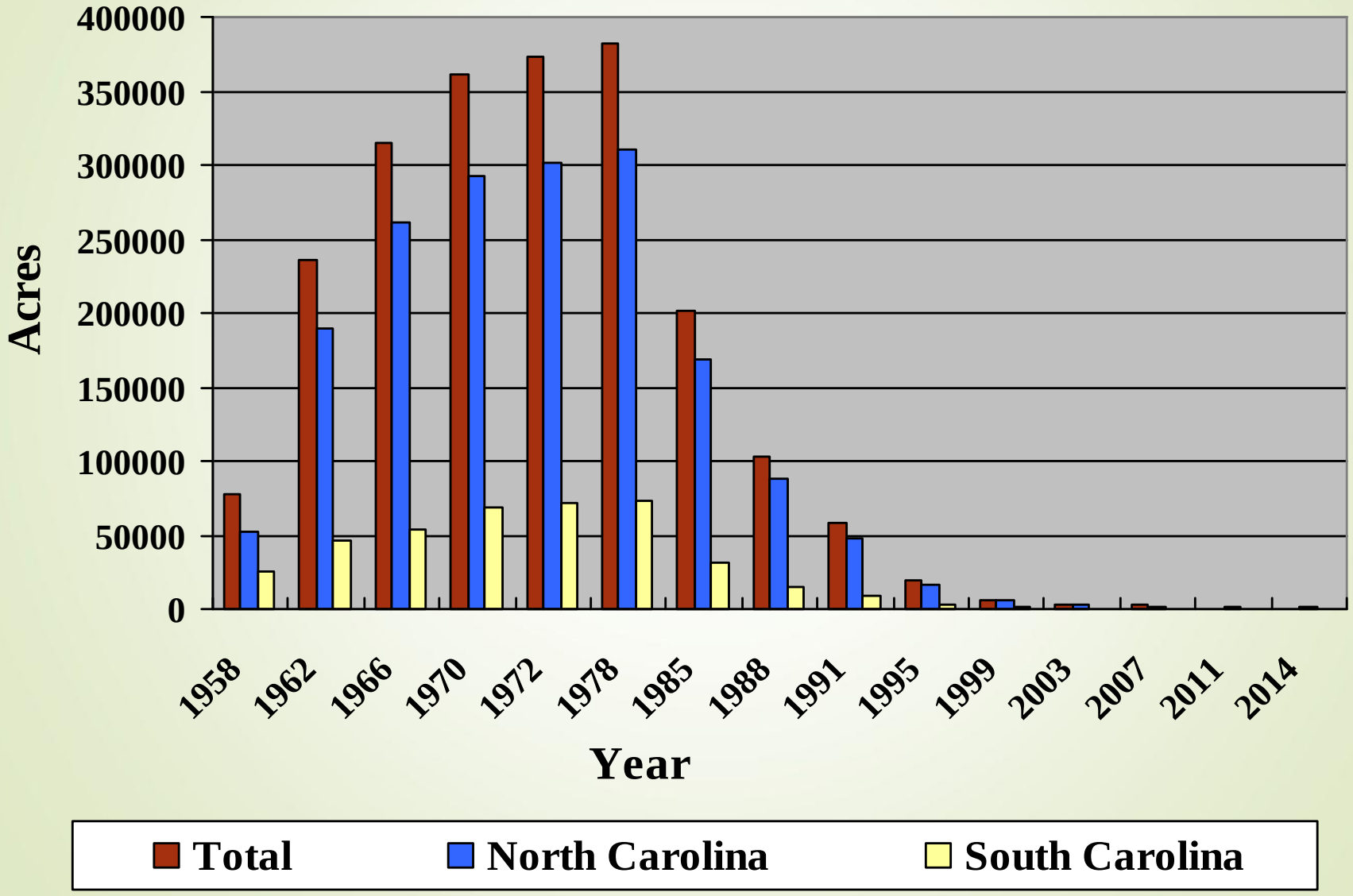
Ethylene to encourage germination of WW seed

History

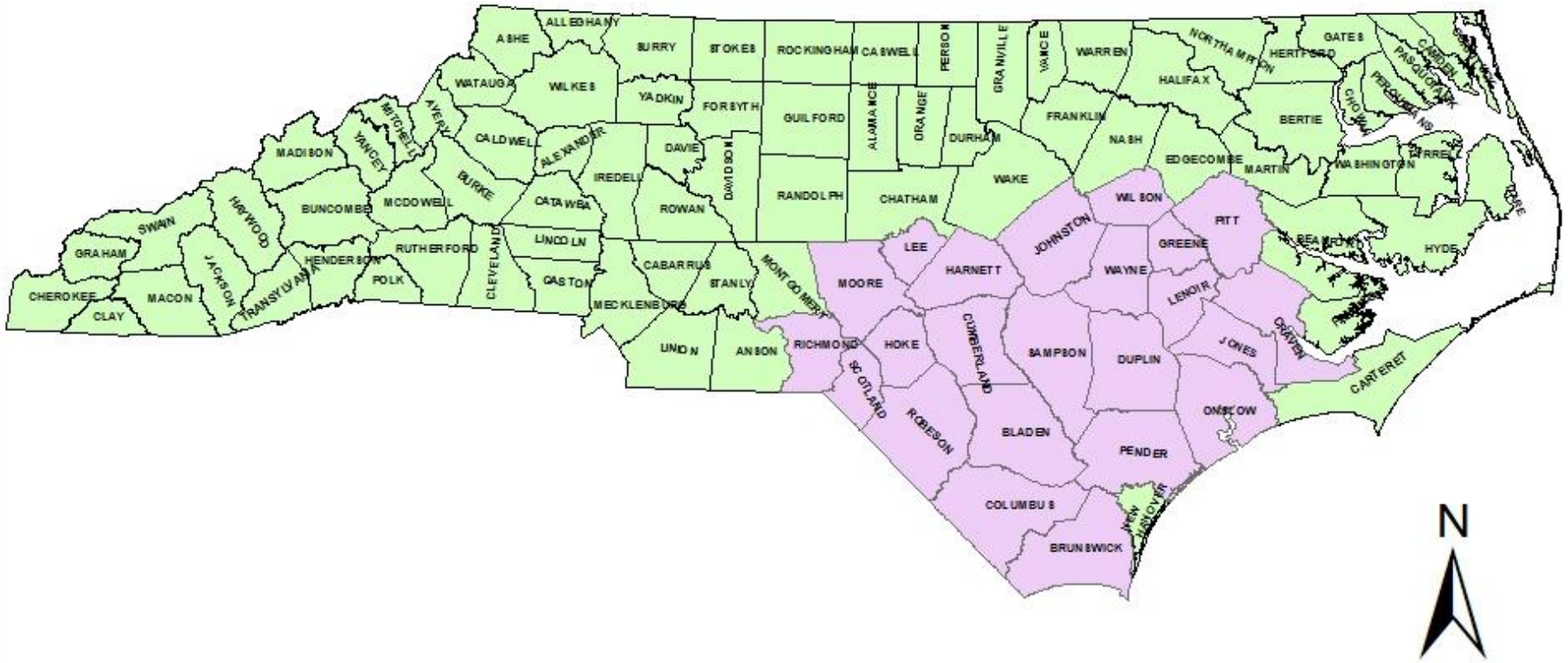
WW Eradication Program Timeline



Historical Record of Infested Acres



Witchweed Infested Counties in 1978

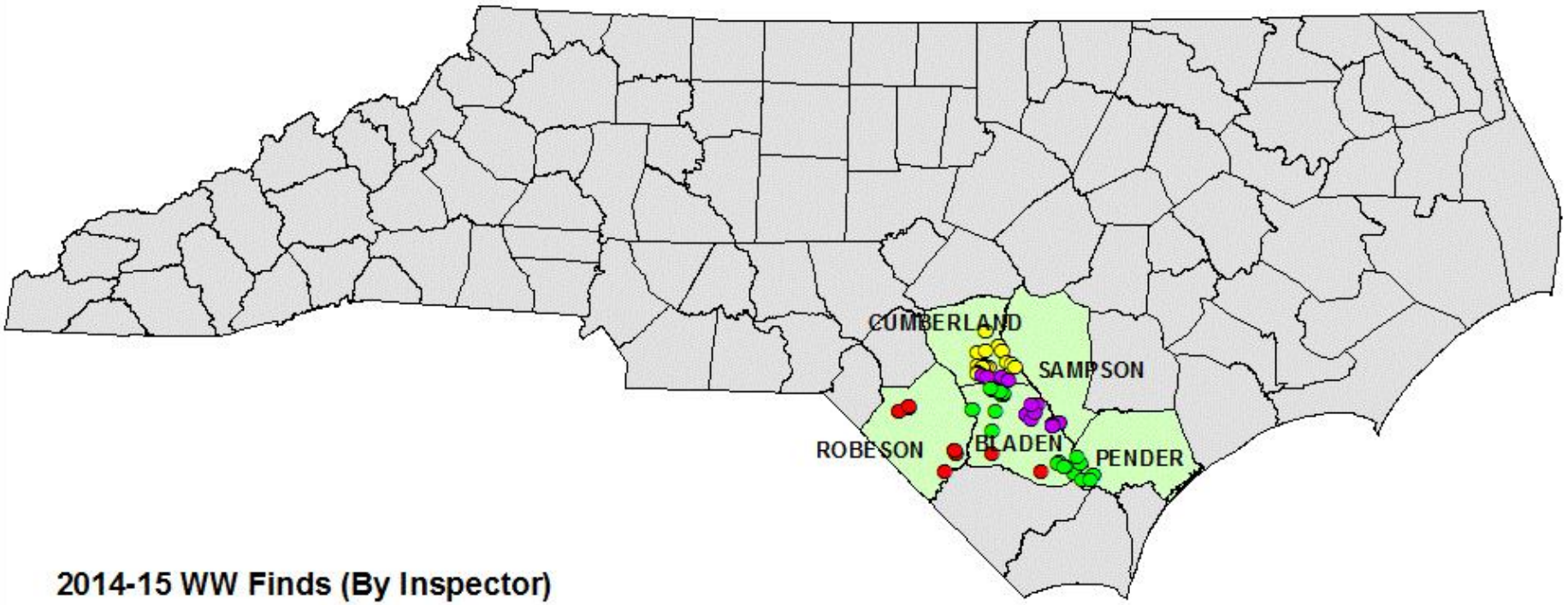


WW Infestation

Infested WW Counties - 1978

The total amount of infested acres for North Carolina in 1978 (as seen highlighted in pink) was 309,853 acres. This number is much higher than the amount infested in South Carolina. The total amount of acres infested in South Carolina was 72,588 in 1978. The grand total of infested acres between the two states for 1978 was 382,441 acres.

Witchweed Distribution
North Carolina
2014-2015



2014-15 WW Finds (By Inspector)

- Chavis
- Smith
- Brewington
- Cooper
- 2014 WW Counties

Source: NCDA & CS - Plant Industry Division

This map was prepared by Justin Karl on September 14, 2015

Farmer Schools

Witchweed Training School, May 25 & 26, 1960, USDA Warehouse, 1405 Godwin Ave., Lumberton.

W. G. Johnston, Work Unit Supervisor. Operation and maintenance of herbicide jeep.

USDA Witchweed Research Lab: 1959-1995

1959 - Original Office and Greenhouses

1978 – Remodeled Office and New Equipment Shop

Eradication Research

- Survey Methods
- Survey Equipment
- Soil Sampling Equipment
- Equipment for Separating WW Seeds from Soil

Eradication Methodology Research

Chemical Control

- Chemical Application Equipment

Cultural Control

- Planting of Catch/Trap Crops (e.g., Corn, Cotton)
- Host Denial and Attrition

Suicidal Germination of WW Seeds

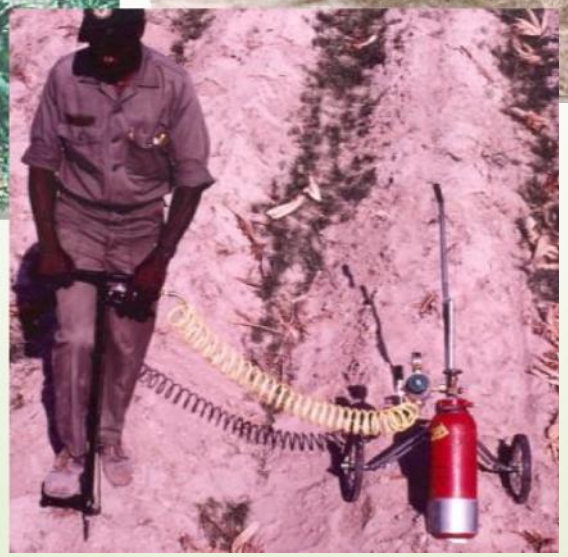
Original Tractor Mounted Shank Injector System

Modified Injector System with Cutting Disk and Rear Wheel Furrow Sealer

Ethylene Injector Systems

High Boy Tractor Ethylene Injector System

Sewing Machine Type Injector for Lawns and Gardens



Handheld Ethylene Injector Probe

Devitalization of WW Seeds

Jeep Mounted Basamid Applicator

Whole Field – Solid Tarp Fumigation

Equipment Cleaning

Methods for Cleaning of Equipment Leaving the Quarantine Area

- Equipment Fumigation with Methyl Bromide
- Equipment Cleaning with Germicidal Detergents
  - E.g. - **Coverage®** (Quaternary Ammonium)

Equipment Cleaning with Germicidal Detergent

Equipment Fumigation

Training of Field Personnel

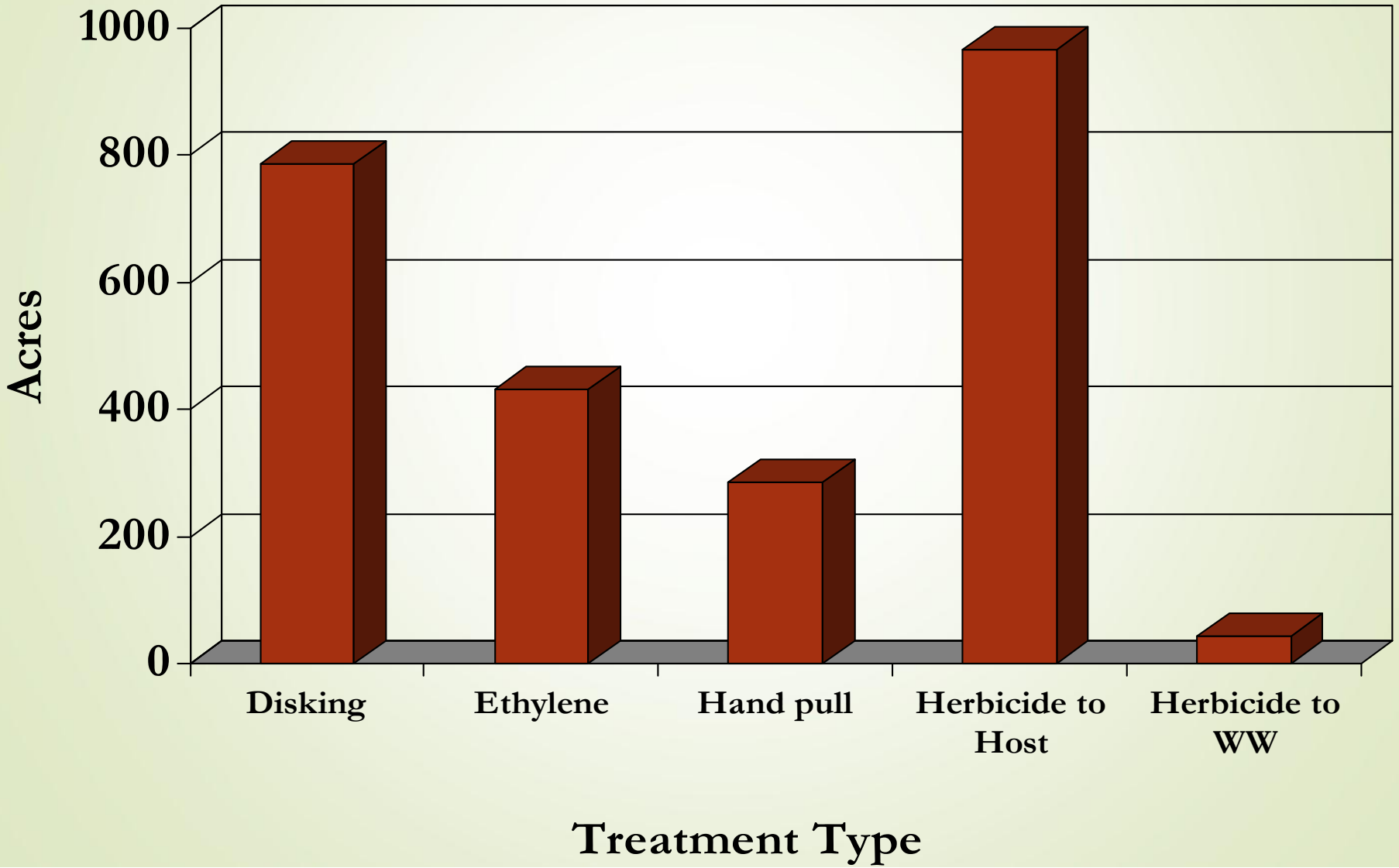
- Annual Witchweed Training School
- Annual Witchweed Field Day

Current Status

Current NC Witchweed Staff

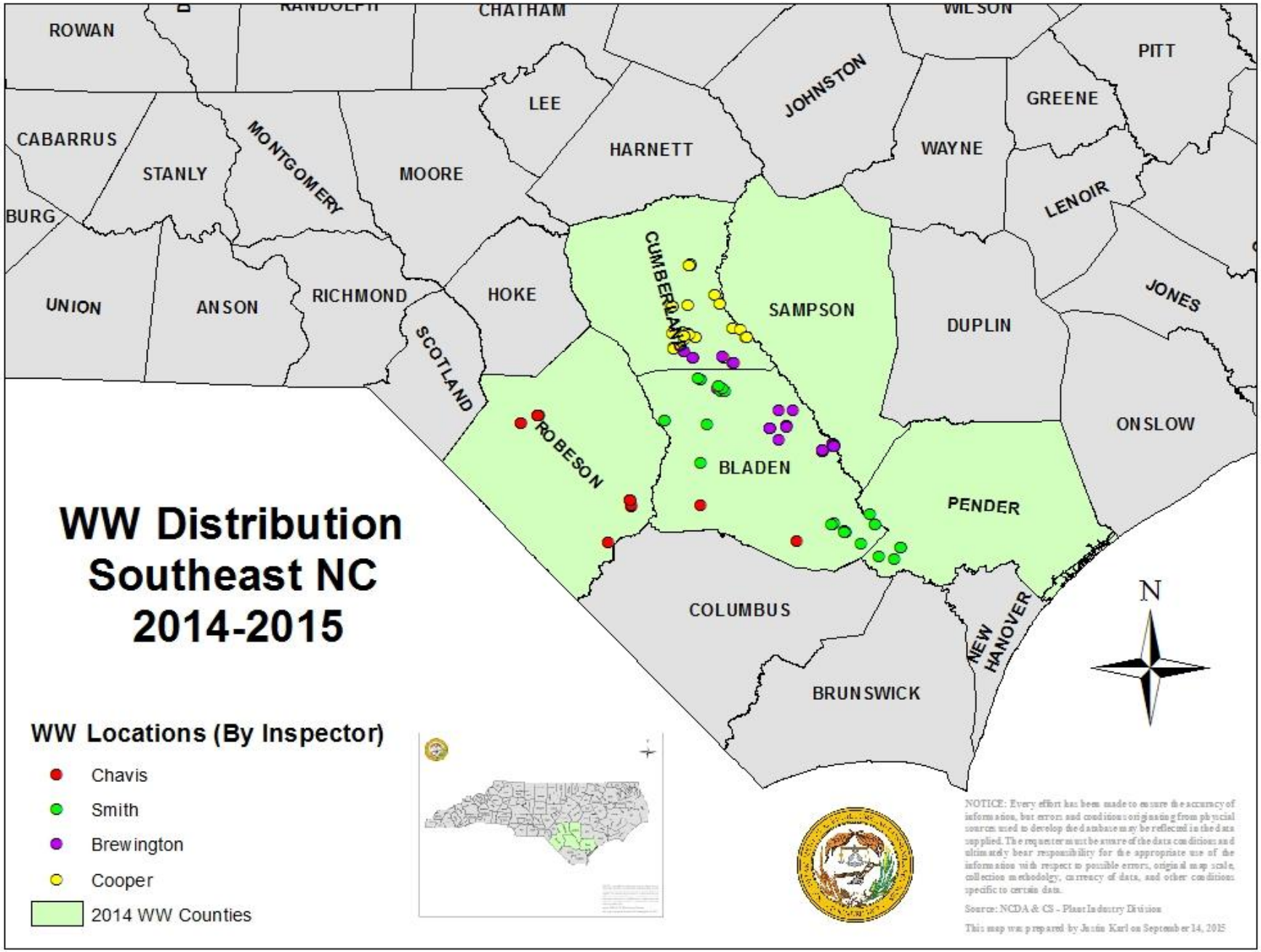
5-full time inspectors/aides, 1-full time Processing Assistant, 2-full time mechanics. 4 field offices in NC: (Fayetteville, Lumberton, Elizabethtown & Clinton)

Treatment Type



Witchweed Status: 2015

Description	North Carolina
Total infested ac	1,134 (90 Farms, 125 fields)
Total ac released	5,250
New/re-infested	176
Net gain	111
Treated acres	2,547
Acres surveyed	77,735


ROWAN
CHATHAM
WILSON
PITT
LEE
JOHNSTON
GREENE
CABARRUS
STANLY
MONTGOMERY
MOORE
HARNETT
WAYNE
LENOIR
BURG
UNION
ANSON
RICHMOND
HOKE
CUMBERLAND
SAMPSON
DUPLIN
JONES
SCOTLAND
ROBESON
BLADEN
ONSLOW
PENDER
COLUMBUS
NEW HANOVER
BRUNSWICK
N
WW Distribution
Southeast NC
2014-2015
WW Locations (By Inspector)
Chavis
Smith
Brewington
Cooper
2014 WW Counties
NOTICE: Every effort has been made to ensure the accuracy of information, but errors and conditions originating from physical sources used to develop the database may be reflected in the data supplied. The requester must be aware of the data conditions and ultimately bear responsibility for the appropriate use of the information with respect to possible errors, original map scale, collection methodology, currency of data, and other conditions specific to certain data.
Source: NCDA & CS - Plant Industry Division
This map was prepared by Justin Karl on September 14, 2015

Summary

- Significant progress since 1957.
  - 23 counties down to 5
  - 380,000 acres down to 1,100 acres
- The program has served as a model for other invasive weed eradication programs
- An organized effort must continue for many more years to ensure complete eradication.