

Vegetable Gardens

Augusta Forestry Center

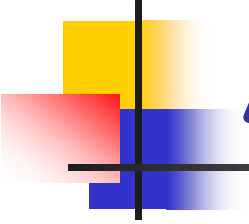
Dean Cocking and Bill Berti

South River Science Team

September 9, 2003

Augusta Forestry Center - Crimora, VA





Acknowledgements

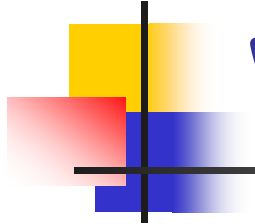
- Lydia Cubbage
- Mike Shifflett
- Don Kain
- Folks at the Augusta Forestry Center
 - Larry Estes
 - Thomas Frazier
 - Carolynn
- Dick Jensen
- Annette Guiseppi-Elie
- Andy Davis
- Barbara Rhodes
- Mike Liberati
- Brenda Kennell

Special thanks to the Center Volunteers including....



Gene Salter

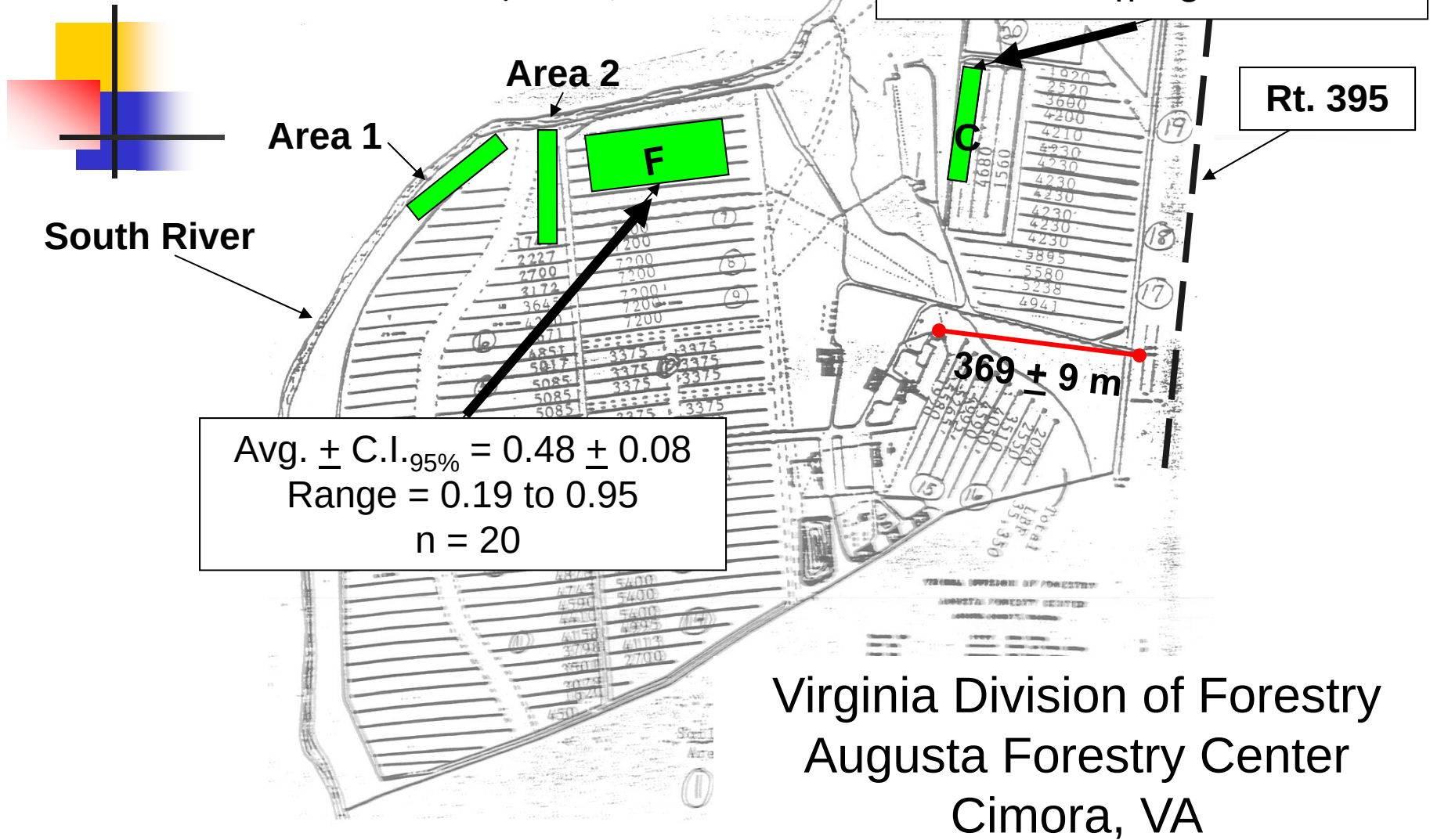
Buba Matthews



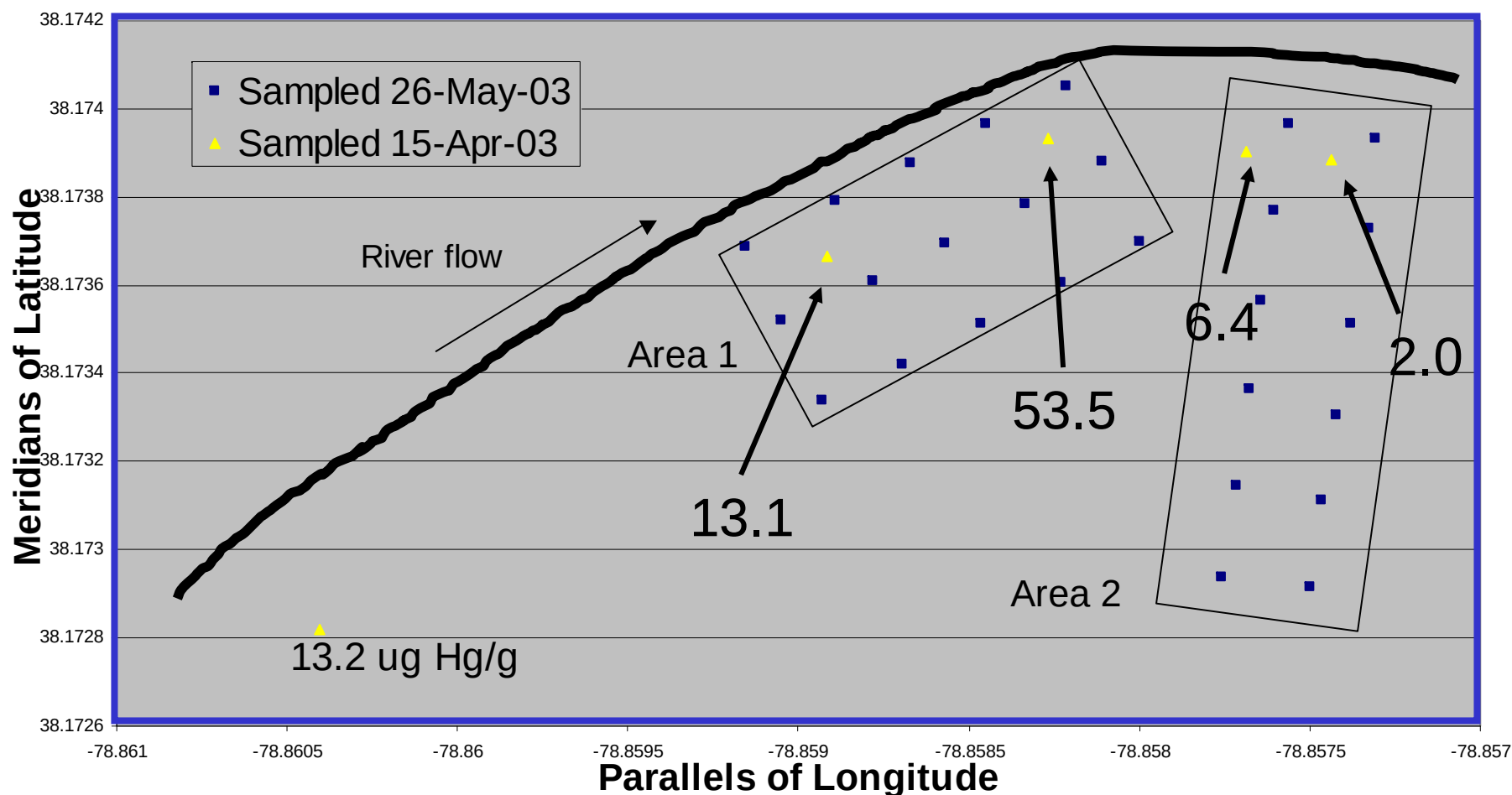
Vegetable Garden Study

Objective - Determine if soil-Hg is taken-up by vegetables at concentrations sufficient to be a health risk

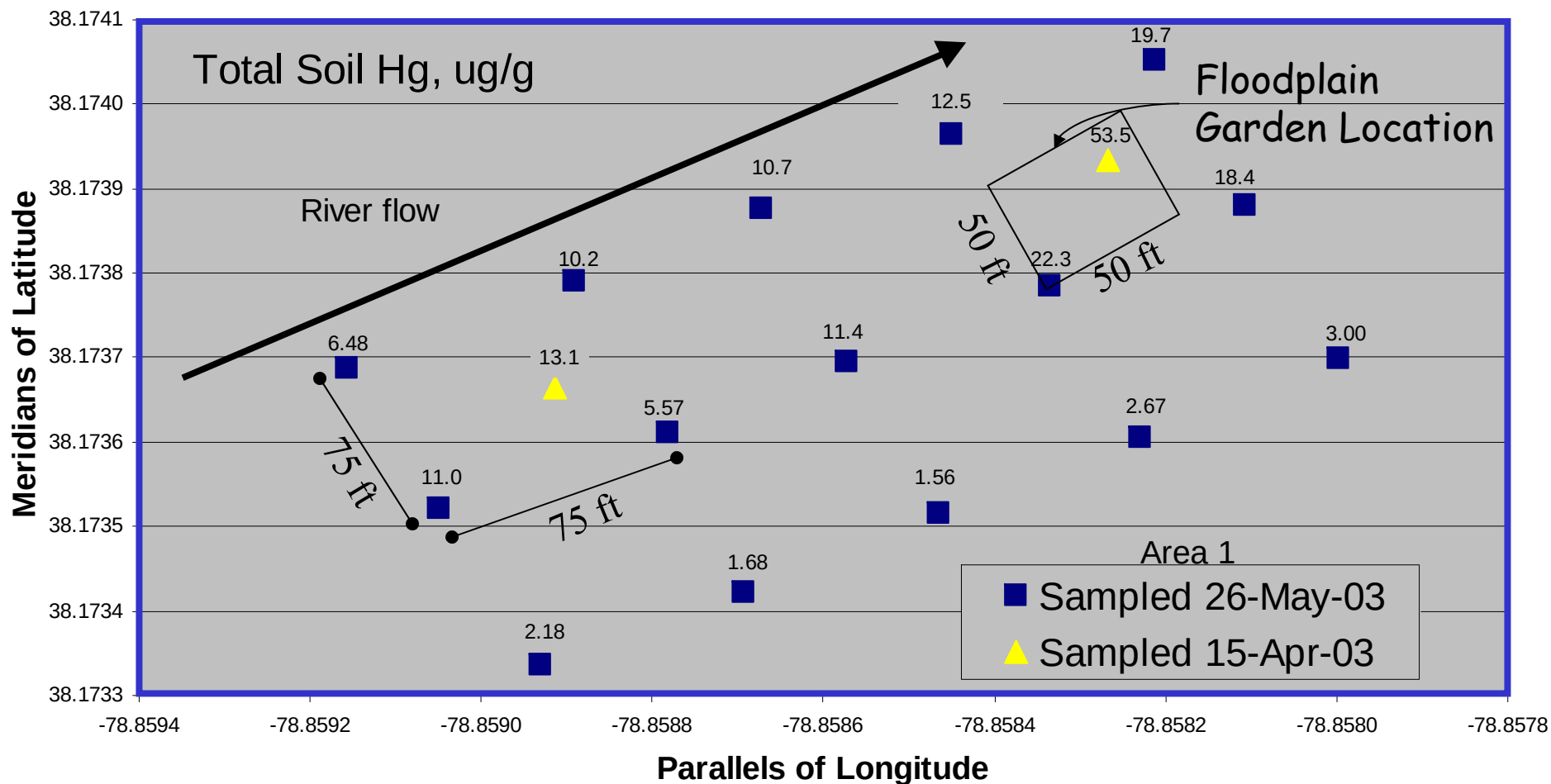
Locations of Areas Sampled April 14-15 Sites "F" and "C"



The April sample demonstrated that there was Hg in the soil in areas 1 & 2, but it was highly variable. **Yellow triangles**



The May Floodplain Area 1 soils contained Hg in reasonable amounts around the April 53.5 ppm location and the garden site was set.



Not to scale



April 2003

Floodplain Area 1

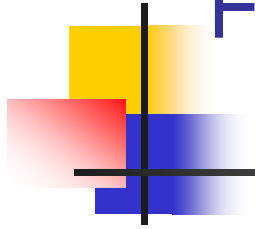
June 2003 - Area 1
was mowed prior to
plowing



The control site "C" contained background levels of Hg and was suitable for use.



Floodplain Garden



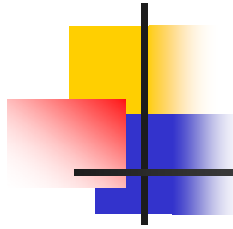
South River



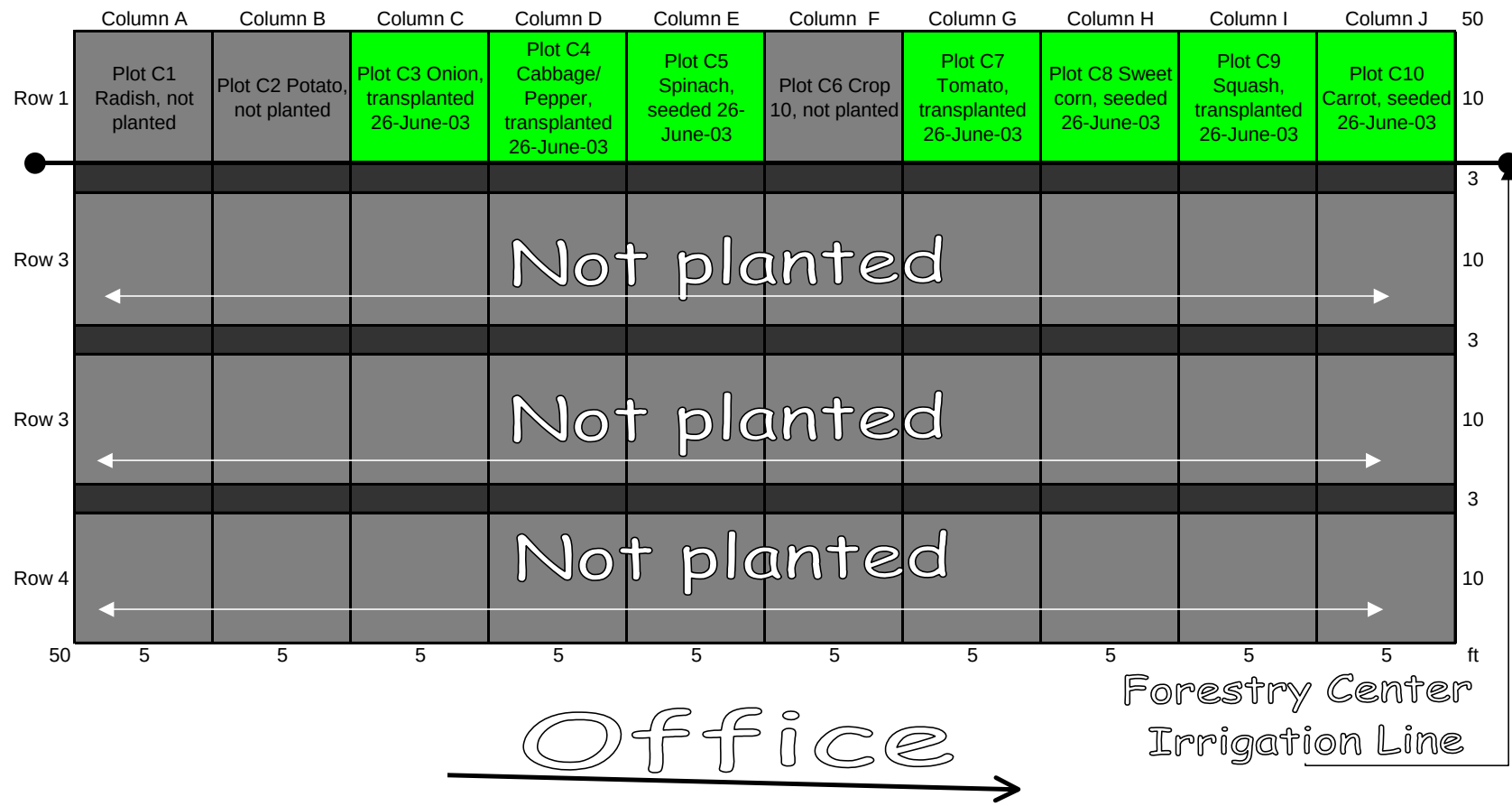
Floodplain Garden - June 2003



Science Team September 9, 2003



Control Garden



Control Garden June 2003



Science Team September 9, 2003

Control Garden June 2003



Science Team September 9, 2003

This was the state of a garden located about 3 miles North of the Augusta Nursery on June 25.

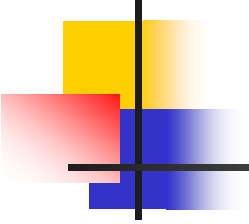
.... the same day the previous slide was taken





Vegetables

Vegetable	Supplier	Name	Comments	Seeded/ Transplanted and Date	Harvest Date
Spinach	American Seed, Norton, Mass	Correnta Hybrid	A superior hybrid Spinach with great flavor and a versatile harvest period. Sow this unique, heat-tolerant variety spring through fall for a continuous harvest of tender, smooth, dark-green leaves.	Seeded 25-June-03	28-Aug-03, from one plot in floodplain garden only
Sweet corn	American Seed, Norton, Mass	Golder Cross Bantam Hybrid	First hybrid sweet corn and still sets a standard for modern varieties. Each slender, eight-inch ear has 10 to 14 rows of golden-yellow kernels with fine flavor. The all-purpose ears are great for canning, freezing, and roasting. The salks mature to six feet tall.	Seeded 25-June-03	
Carrot	Burpee, Warminster, PA	Danvers Half Long	Fine-grained and tender with a very sweet flavor. Grows uniformly 7.5 inches long, about 2.5" wide tapering to a blunt end. Ready to harvest in about 75 days.	Seeded 25-June-03	
Tomato	Riverside Plants Dayton, VA	Park's Beefy Boy	VFFFTt Full sun 70 days to maturity -main Season beefsteak type - 12 - 16 oz	Transplanted 25-June-03	
Squash	Riverside Plants Dayton, VA	Yellow straight neck	Generic - creamy yellow 4 - 10" matures in 46 - 52 days.	Transplanted 25-June-03	28-Aug-03
Cabbage	Riverside Plants Dayton, VA			Transplanted 25-June-03	28-Aug-03
Onion	Hess Greenhouse Harrisonburg, VA	Walla Walla	110 days. Large, flattened, globe shaped bulbs with light brown skin and mild white flesh	Transplanted 25-June-03	
Pepper	Riverside Plants Dayton, VA	generic		Transplanted 25-June-03	28-Aug-03



General Garden Growth

Overall, the control garden started faster, but the floodplain garden caught up as the season progressed. Future considerations:

- watering consistency in both amount and timing
- try to obtain greater similarity in soil nutrient status
- other soil properties need comparison (eg. sand content)
- the fact that the control had been used for gardens in recent history and the floodplain had been mowed grassland may have had an impact. (disease sources, weed presence, texture, etc.)



June 25



July 19



July 26



August 9



August 16



August 23

Garden development at Floodplain site, 2003



June 25



July 19



July 26



August 9



August 16



August 23

Garden development at the control site, 2003



Floodplain Garden
Aug. 28, 2003
Harvest stage one



Control Garden August 28, 2003

Harvest stage one.



Harvested August, 2003

Sweet Bell Green Peppers

- Generic transplants from Riverside Plants in Dayton, VA
- Grew well at both gardens.
- More than enough fruit for analysis



Floodplain garden



Control garden

Harvested August, 2003

Yellow straight neck squash

- Generic transplants from Riverside Plants in Dayton, VA
- Grew well at both gardens but control was at maturity before the floodplain



Floodplain garden



Control garden

Harvested August, 2003

Head Cabbage

- Generic transplants from Riverside Plants in Dayton, VA
- Grew well at both gardens once transplants took hold.



Floodplain garden



Control garden

To be harvested, Sept 2003

Walla Walla Onions

- Transplants from Hess Greenhouse, Harrisonburg, VA
- Grew well at both gardens .



Floodplain garden



Control garden

To be harvested, Sept 2003

Park's Beefy Boy Tomato

- Transplants from Riverside Plants in Dayton, VA
- Grew extremely well at both gardens .



Floodplain garden



Control garden

To be harvested, Sept 2003

Park's Beefy Boy Tomato

- A 70-day beefsteak type tomato few seeds, has a large amount of solid tissue



To be harvested, Sept 2003

Golden Cross Bantam Hybrid sweet corn.

- The corn at the control garden grew much more rapidly initially
- The plants at the floodplain garden have now caught up.
- The small number of plants in each plot may have inhibited pollination and therefore the ears may not be beautiful, but they should yield sufficient tissue for analysis.



Floodplain garden



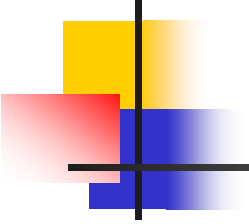
Control garden

Science Team September 9, 2003

Two types of problems

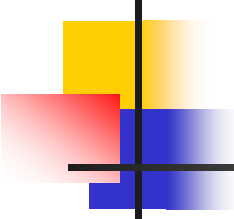
1. The squash at the control developed a fungal disease. □(Large squash tissue samples were still available; small fruits were obtained from adjacent volunteer garden.)
2. Wind damage to corn, requiring staking.





Hg analysis with plant tissue

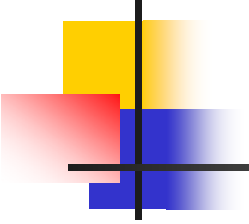
- Searched for a universally accepted standard for Hg determination in plant tissues.
- Found a number of different tissue preparations but no "standard". The results from each are similar.
 - most used dried (air or oven at various temperatures) and ground the samples in a mill
 - some used freeze dried or wet samples
- Cold vapor AA with hydride generation generally used, but occasionally ICP



Lancaster Laboratories

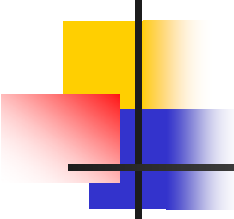
Bill Berti, Barbara Rhodes, and Dean Cocking met with the analytical team and managers on July 10 in Lancaster, PA.

- discussed alternative analytical techniques for the plant materials.
- examined various ways to prepare samples and transport them to Lancaster.
- brought up quality control issues and discussed how standards, spiked samples, duplicate samples, etc. could be handled.
- Hg in plant materials is relatively new to them, but they were willing to develop protocols. More experienced with Hg in soils and fresh animal tissues.



Analysis protocol

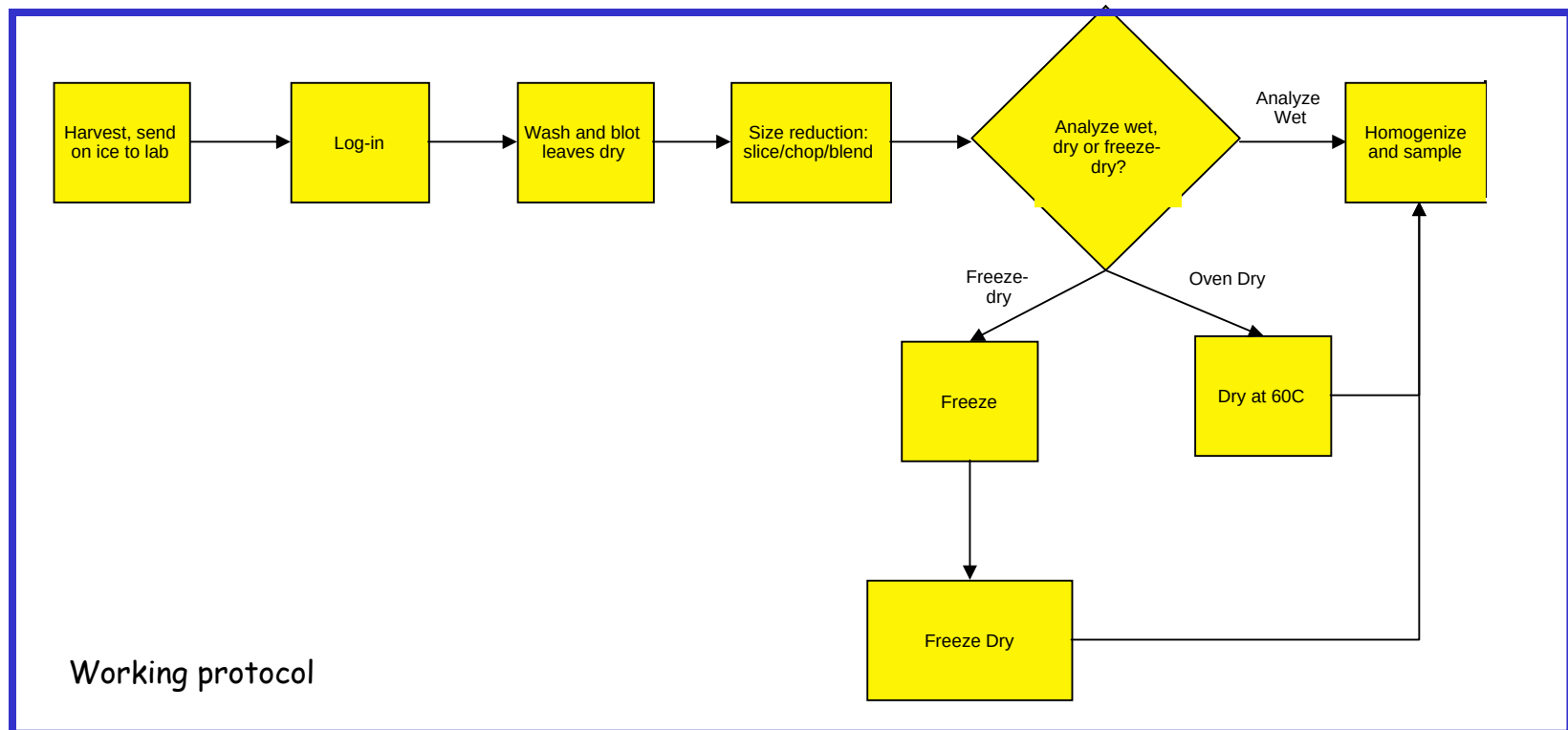
1. We liked the idea of freeze-drying because it appeared to produce consistent samples - but was going to be extremely expensive - Lancaster quoted \$75 per sample
2. They preferred to use undried samples - wanted material as fresh as possible.
3. They would use Cold vapor AA and provide spiked sample information as well as quality control data.



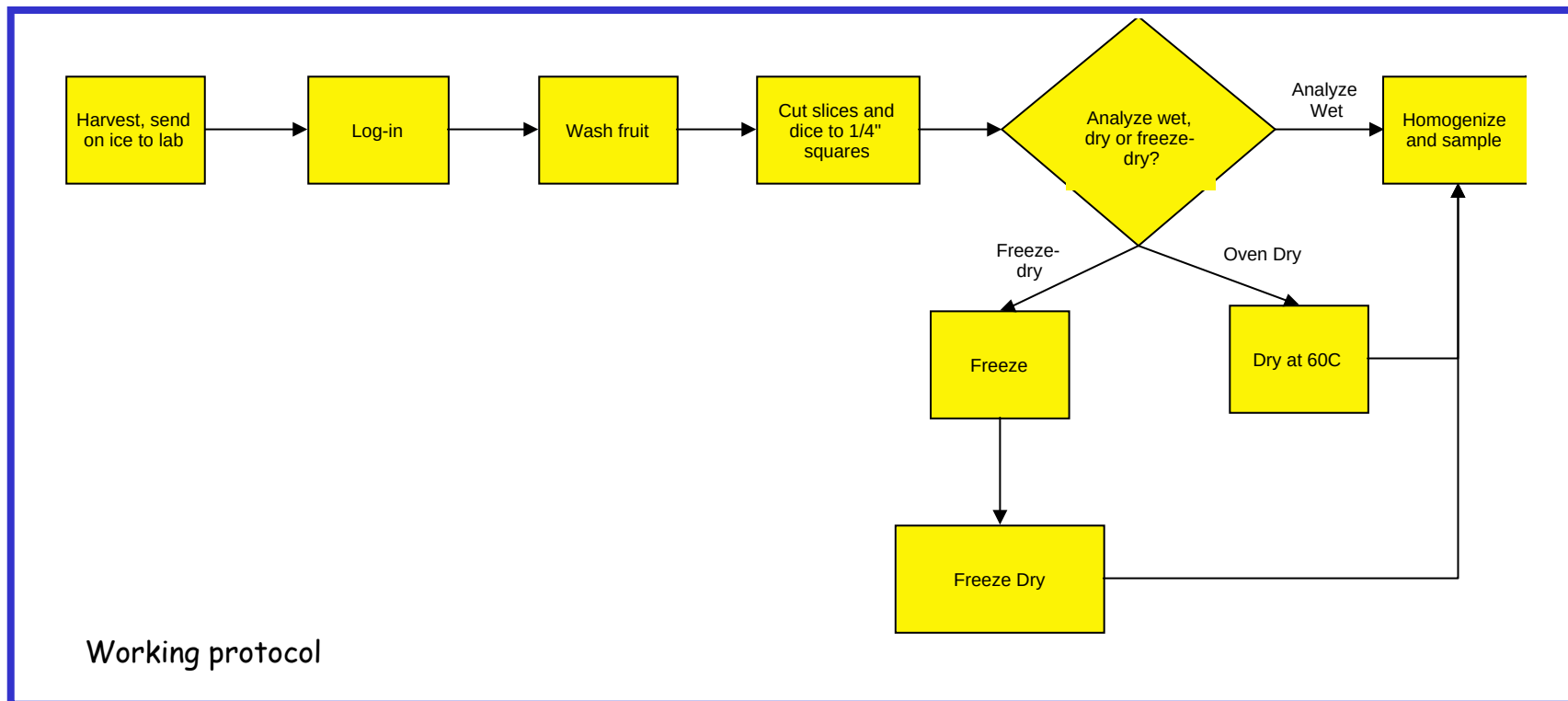
Current status

- First harvest 28-Aug-03
- Squash, cabbage, green pepper
 - Wash vegetables, slice, and chop
 - Digest and analyze for total Hg
 - Wet sample: All initial samples
 - Dried at 60° C: limited number of samples
 - Freeze: Freeze-dry limited samples
 - Compare sample preparation methods

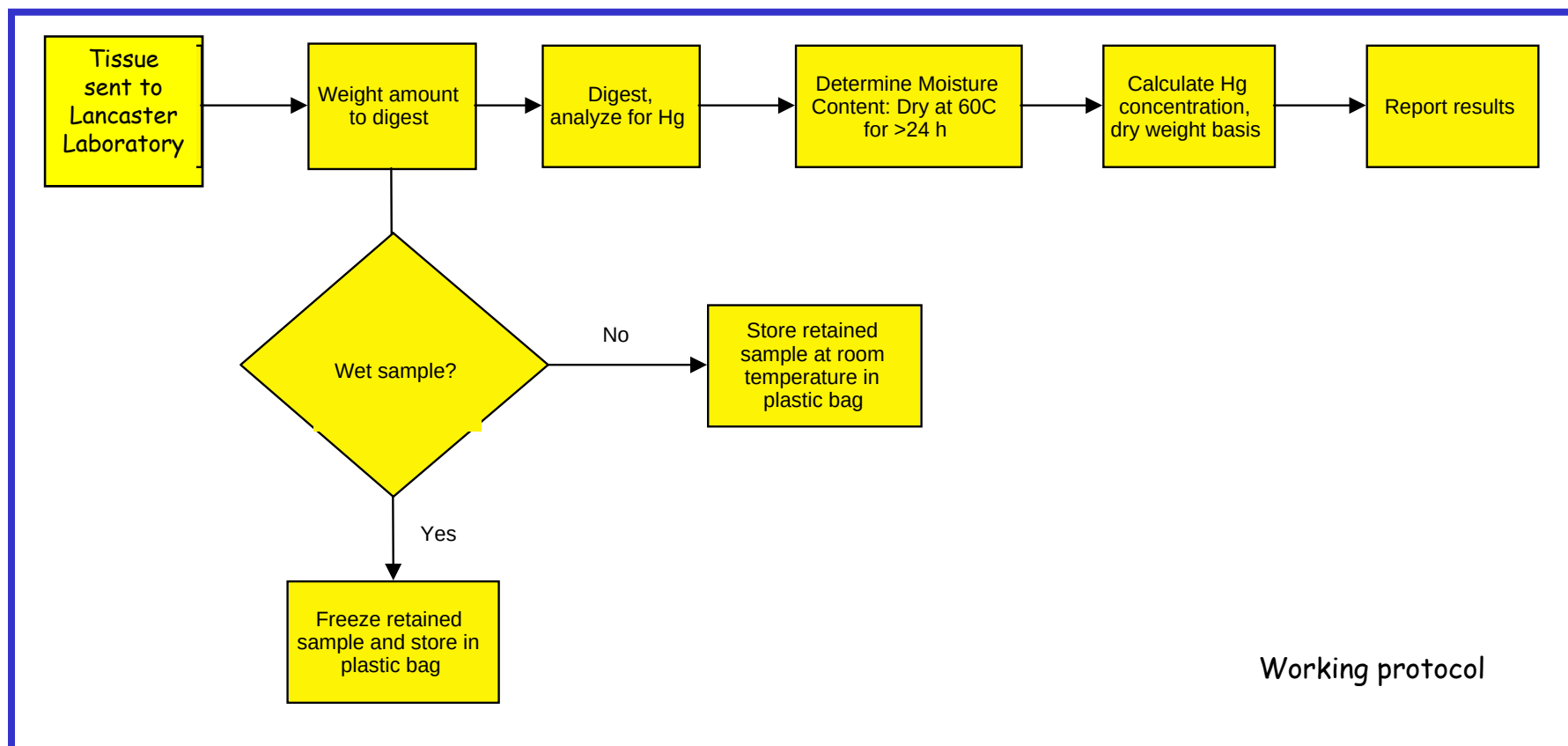
Preparation of leafy samples

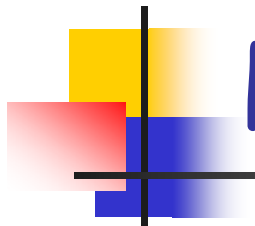


Preparation of fleshy samples



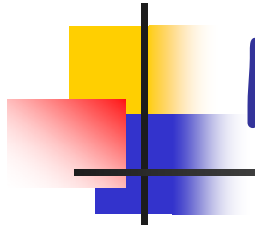
Samples undergo Hg analysis





Path Forward

- Continue to harvest when ready
 - Tomato, spinach ?, carrots, onion, sweet corn
- Plant fall crop and harvest in November
 - Lettuce, radish, possibly spinach
- Collect soils from plots for total Hg
 - Will be done after vegetables are harvested
 - Composite sample for soil testing from each plot
 - pH and plant nutrients



Path Forward

- Clean-up gardens for winter
- Begin planning for Spring 2004
 - Apply limestone, if recommended by soil test
 - "Rotovate"... this is what the forestry center personnel call rototilling

