K&C Phase 3 – Brief project essentials

- *Combined Use of SAR, InSAR and Lidar for Measuring Forest Biomass and Structure in the Northeastern United States*

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Project area

The area is the Northeastern US, centered around the Harvard Forest located in Western Massachusetts, where considerable ground validation and remote sensing data are available.

We are also studying the impact of an invasive species, Hemlock Woolly Adelgid (HWA; one of our less welcome imports from Japan in the 1950's), which is decimating the population of Hemlock forests in the region. Hemlock forests are considered a foundation species for the US northeast and southest regions. Being a shade tolerant species with a long lifetime, the infestation of HWA is expected to have a strong impact on the forest structure and forest carbon cycle.

Project objectives

The thematic driver for this project is Carbon Cycle Science, where we are developing algorithms for characterizing vegetation structure using L-band SAR. NASA's DESDynI-R (same as DESDynI, but now without the lidar, hence *Radar* only).

A fundamental goal of DESDynI-R is to address needs of the ecosystem science community, which includes the mapping of forest structure, biomass, and landcover change.

With the loss of the current ALOS-PALSAR, and in anticipation of ALOS-2 and DESDynI-R, we intend to extend our previous analysis over the Harvard forest and interferometrically map the Northeastern United States using historic ALOS-PALSAR data.

Project schedule

- Identify ground validation and data products currently available that will be useful for JAXA's efforts in forest mapping (present – March 2012)

- Provide JAXA with version one of data (April 2012)

- Peform interferometric mapping over the Northeast using FBD data (May 2012 – May 2013); Map region shown in slide 10.

- Incorporate interferometric FBD data with ancillary optical and NLCD (National Land Cover Database) and Woods Hole data for the region. (May 2013 – March 2014)

- Assess advantage of adding interferometric layer for vegetation structure characterization (March 2014)

Support to JAXA's global forest mapping effort

This project will support JAXA's global forest mapping effort in the following ways:

- provide ground validation data for the Harvard Forest region (35 hectare ground validation biomass map)

- provided extended region of biomass estimates derived from full waveform lidar data (LVIS) and multibaseline L-band PolInSAR.

- L-band algorithm development will aid in developing algorithms that will be applicable to ALOS-2.

Deliverables

Planned output of the project.

☐ Biomass measurements for 15 one-hectare plots currently available for the Harvard Forest (currently available)

☐ Tree height map for the extended Harvard Forest region (currently available)

☐ UAVSAR L-band interferometrically derived heights (1st version available within one year)

☐ ALOS/PALSAR interferometric results for the larger region (end of project)

☐ recommendation for configurations and viewing stragety for ALOS-2 (continuing)
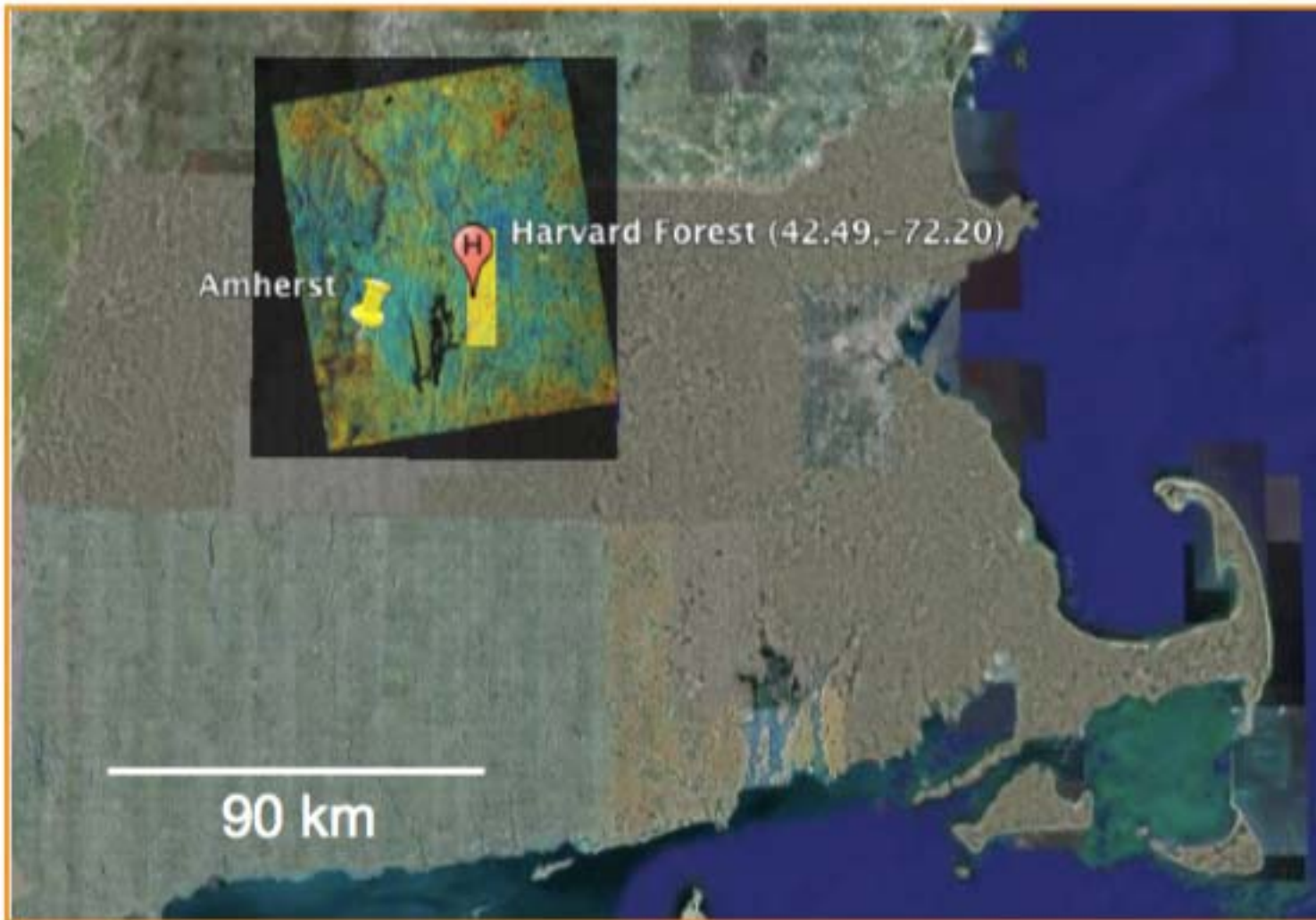
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25 Hectare Stem map of Harvard Forest
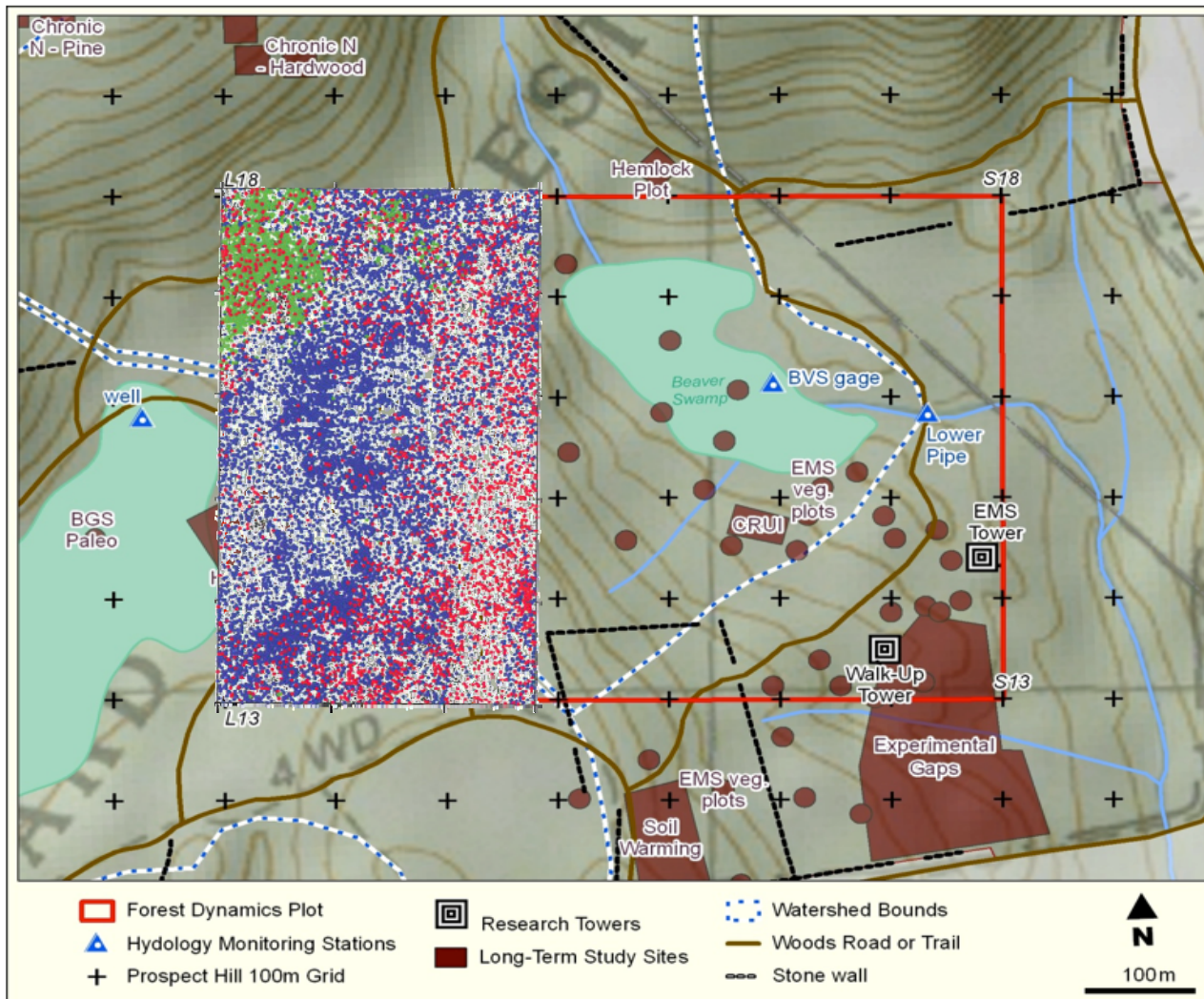
Being performed by collaborators at the Harvard Forest

Stem map area indicated in red at left; all stems greater than 1 cm diameter are being mapped

1/3 of area currently mapped (mountain laurel-green; hemlock-blue; red pine-red)

An image of the current remote sensing data

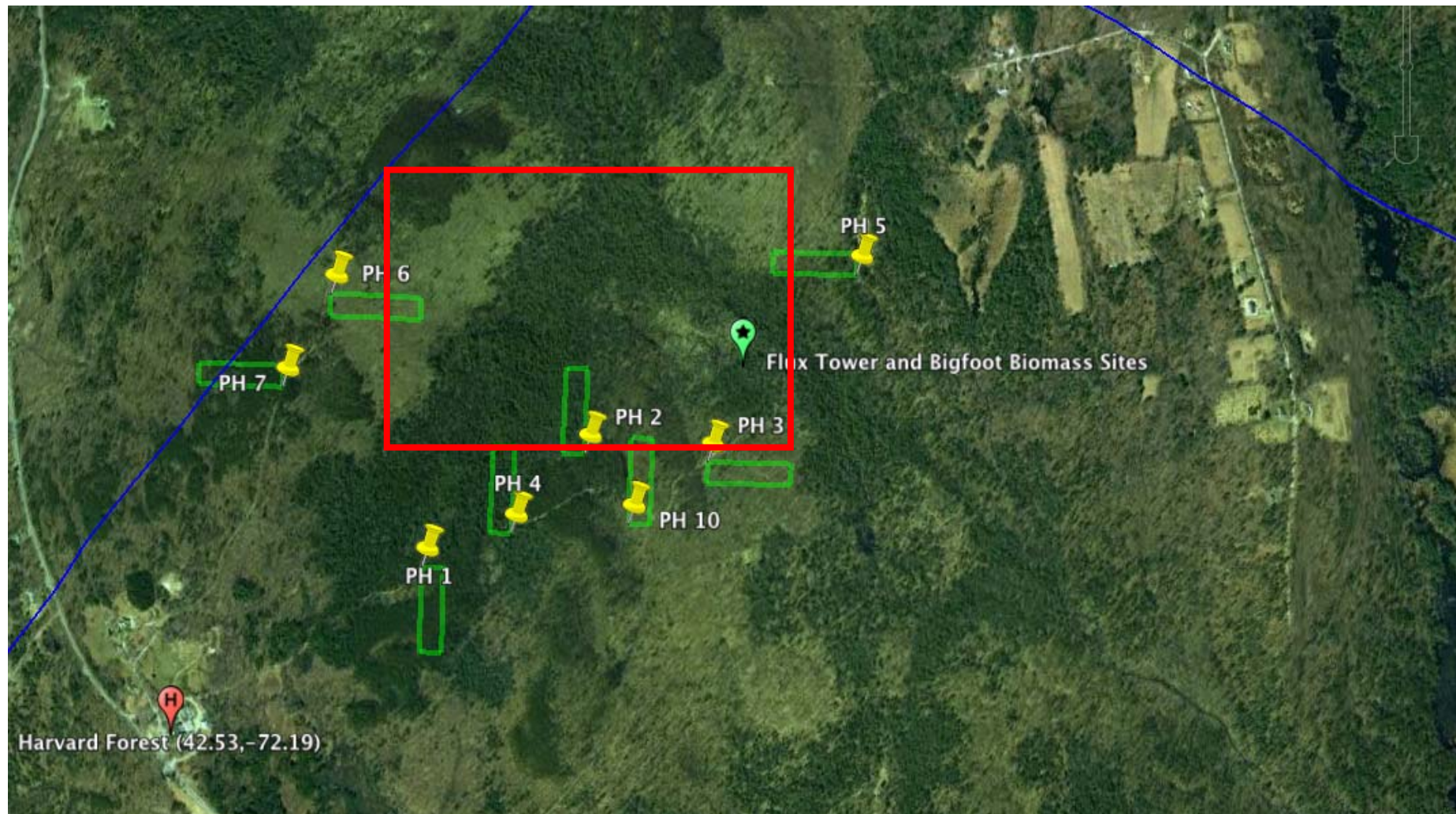Harvard Forest (42.49, -72.20)

Amherst

90 km

Shown at left is the state of Massachusetts, the location of Amherst (UMass), an ALOS/PALSAR FBD differential interferometry image for the region (large scene) and a tree-height image derived from the LVIS full-waveform lidar sensor.
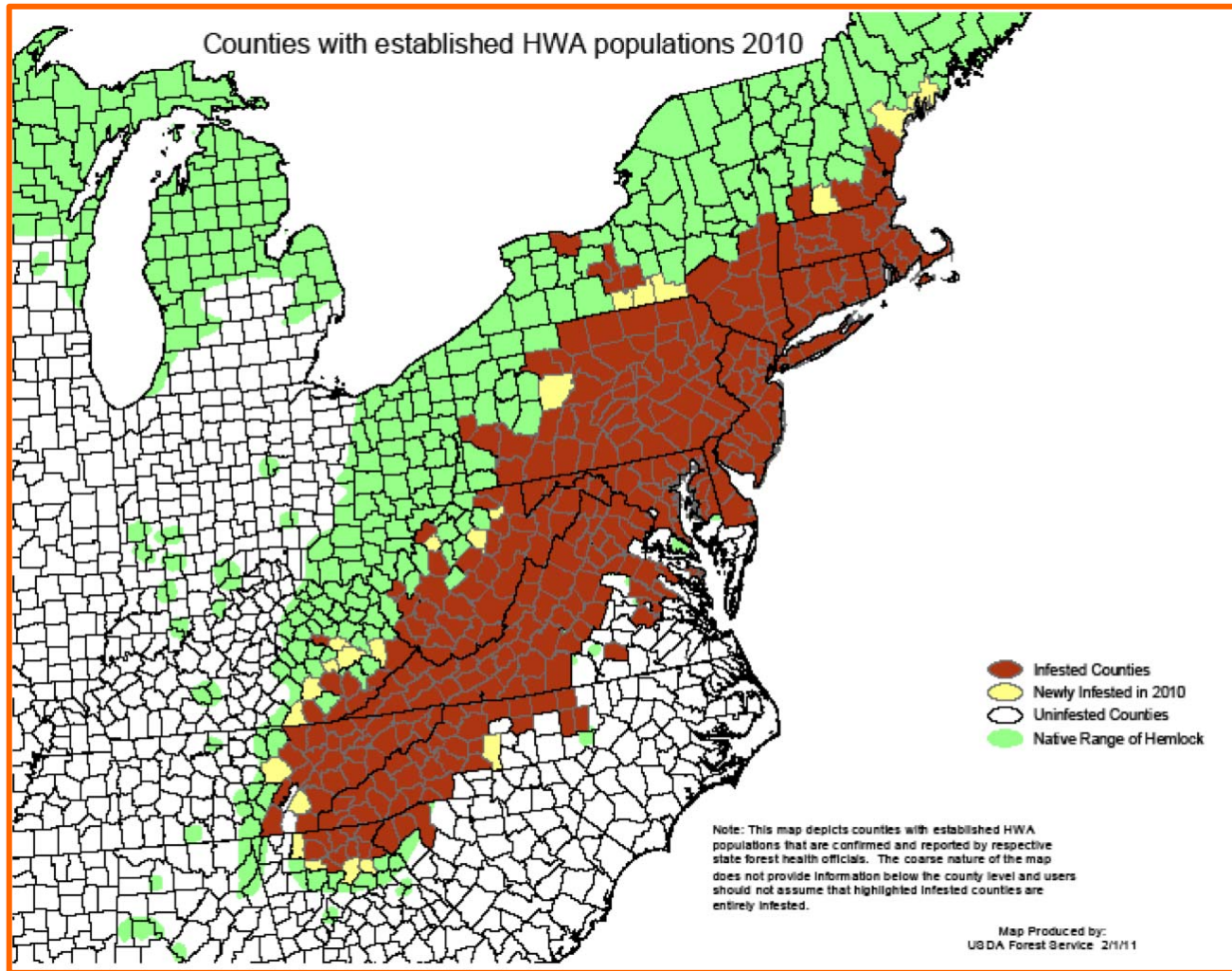
In 2009, UAVSAR made repeat-pass measurements over the region and the data is currently being processed.

apologies to those who have seen this before

Existing ground validation (green) and 35 ha stem map (red)

The goal of a larger region

Counties with established HWA populations 2010

Infested Counties
Newly Infested in 2010
Uninfested Counties
Native Range of Hemlock

Note: This map depicts counties with established HWA populations that are confirmed and reported by respective state forest health officials. The coarse nature of the map does not provide information below the county level and users should not assume that highlighted infested counties are entirely infested.

Map Produced by:
USDA Forest Service 2/1/11

We would like to tie part of our effort to a larger work for characterizing the impact of the invasive species, Hemlock Woolly Adelgid (HWA).

At left shows the native region of the Hemlock (green) and the region that have the infestation (brown)

We would like to make a map, similar to that shown at left, that will have some amount of structural information that will be relevant to this effort.

By tying this work to a larger effort will increase its visibility