Dead Marsh Remote Sensing Recommendations
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(Abridged and web posted by J. Flory)

In this brief I will try to provide my best recommendations for acquiring remotely sensed imagery to delineate the location and extent of marsh die off, or what researchers in Louisiana refer to as Marsh Dieback Syndrome (MaDS). Much of what I will be recommending in terms of the sensor is based on the experience in Louisiana most notably from Chris Wells with the US Geological Survey in Lafayette.

Baseline Data
The 1998 Color-infrared digital ortho quarter quads (DOQQs) flown and rectified by the state will make suitable baseline data for the project. The UGA Marine Extension Service is in the process of entering into a data sharing agreement with Georgia Tech to get copies of these images. MAREX will buy a snap server to host the imagery with an external DVD burner to disseminate the data and will make it available to our cooperators free of charge. A CD burner will also be attached if the cooperator can't read DVDs. If a map of MaDS areas is produced it would be good, but not absolutely necessary, to share this data with Georgia Tech in the spirit of the data sharing agreement.

The options available to us are as follows:

Option A: 10,000 in NOAA provided data
This option is available from the National Geodetic Survey branch of NOAA - the Remote Sensing Division. Within the last 6 months they have acquired a range of imagery on the coast - see Figure 1. These images are of a suitable timeframe, however the spectral and spatial resolution remain open questions. Apparently the contractors have not "calibrated the camera" and therefore cannot at this point give us a clear number on the pixel size of the imagery. NOAA will get back to me on the exact calibration, but we are told that it will likely be better than 1 meter. As a rule of thumb you should have a pixel resolution half of the size of the smallest object you are trying to detect in the image. So if we wanted to survey all marsh patches 0.5 acres in size or larger (and I am not implying this is the goal here) then ideally we would have an image with a spatial resolution of about 1012 square meters. The CIR DOQQs are 1 meter resolution.

NOAA acquired a range of imagery on these missions. NOAA tells me that the areas of the coast not covered in the index in Figure 1 have been flown and that the data will be available this summer.

Where the photo index indicates the availability of ***bw/ir*** data, it means that an infrared sensor was used to record the reflectance data, but that it was printed as a black and white image. Researchers in Louisiana recommended that we acquire color infrared imagery to detect MaDS, so it is unclear if this data is suitable for our needs. NOAA will be forwarding a sample of a bw/ir image (covering the portion shown in yellow in Chatham

county in Fig. 1) to Jan MacKinnon to see if she can discern the dieback areas in this type of dataset. Color negatives are also available, and again, it is unclear if these images would be suitable. NOAA has sent Greg McFall a sample true-color image to check for suitability, which he has sent on to Jan as well, so she can evaluate the spectral and spatial resolution of all of the recently flown NOAA imagery.

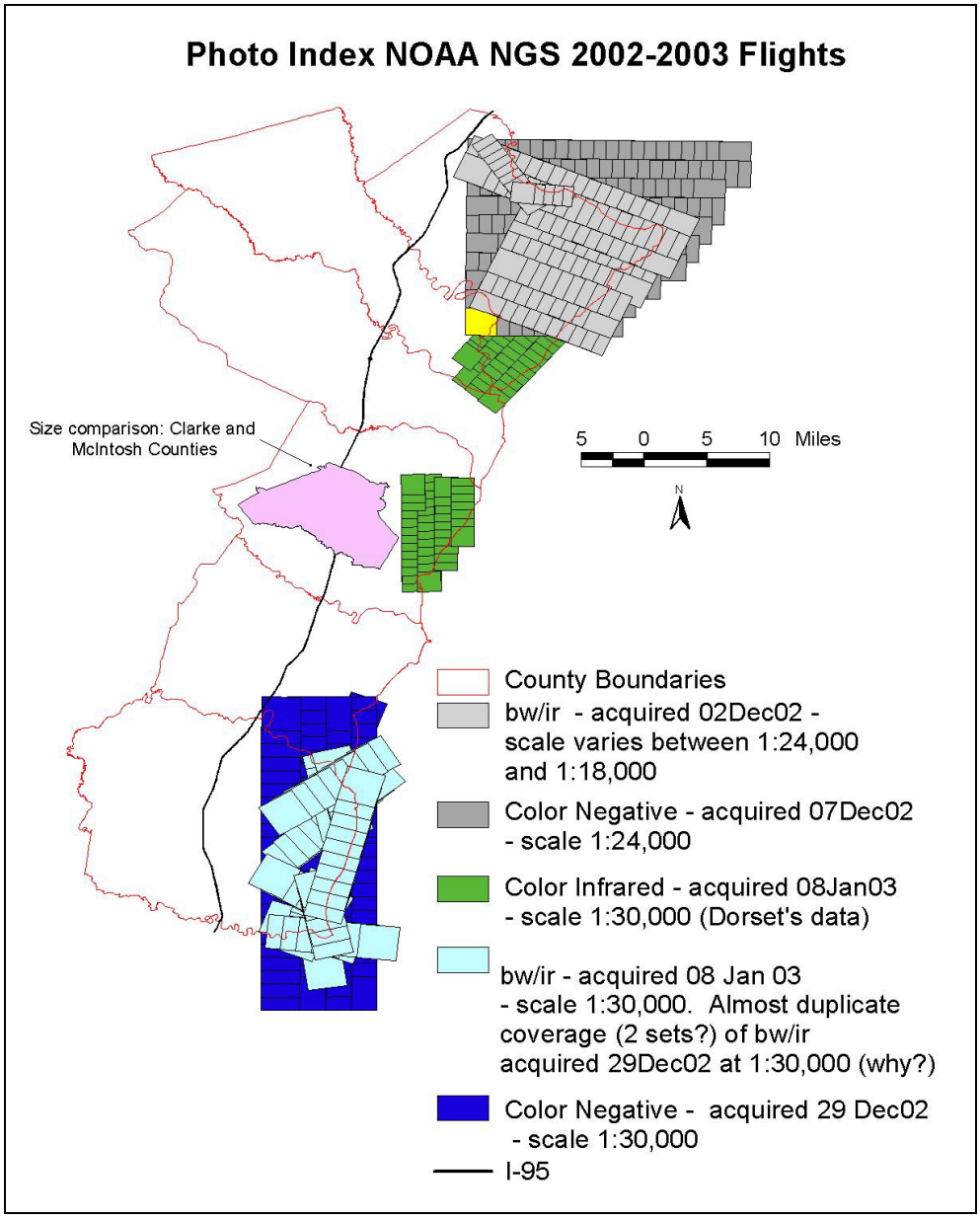

Figure 1. Photo index of NOAA 2003-2003 coastal flights.

Cost estimates (abridged)
Contact me for the details.

- $11,000 – 13,000 to acquire unrectified, digitized (scanned) imagery already flown by NOAA
- $175 to scan the images from Dorset (labor estimate only, not including scanner, CD's or other storage device)
- $3,300 to rectify both sets of photos or digitized areas
- $100 – 300 for software

Option B: $10,000 in new NOAA flights
This option is available from another division of NOAA - although I have not determined which division or who the contact person is there. I have been told by Brian Baldwin and Brad Kearse that this option would use an old RC8 camera that is capable of flying color infrared film, at an unspecified resolution. According to Brad Kearse, it would be very difficult to rectify the imagery, and $10,000 wouldn't be enough money to pay for an entire imagery set for the coast. We would also have to include the cost of digitizing (scanning) the imagery. The statement from Brian and Brad regarding the high cost estimate for the flight itself is in line with my experience of aerial photo pricing. For example, within the last 6 months Clarke County signed a $100,000 contract to fly very high resolution, true color orthorectified photos and to update the contour lines. The product will take a year to deliver and it cost $100,000. The size of Clarke County compared to the rest of the coast is shown in figure 1 above. However, if the bw/ir is not suitable for MaDS mapping and if NOAA is willing to donate $10,000 worth of flight time then we shouldn't necessarily disregard this option - some imagery is better than none at all. At that point the question should be the best way to set priority areas for the limited amount of air time available. And I have yet to determine what or what is not included in the "$10,000" figure in terms of a pilot, fuel, film, processing, a camera technician, etc.

Option C: New acquisitions outside of NOAA
If neither the BW/IR nor the true color images are appropriate for mapping the MaDS, and/or if we wish to acquire imagery for areas not covered in the NOAA flights or next year then one option would be high resolution satellite data. In this case I would recommend a data buy from either SpaceImaging (using the IKONOS platform) or DigiGlobe (using the QuickBird platform). It would be advantageous to request a sample image from the GA coast from both companies before purchasing, and I will be happy to help with that once Jan determines if the bw/ir is or is not suitable.

Area east of I-95:	969,082 ac (392,180 ha)
Area covered in NOAA (2002/2003 known flightlines):	483,156 ac (195,527 ha)
Area covered by the estimated 150 photos not shown in fig1:	156,669 ac (63,401 ha)
Est. area E of 95 not covered in NOAA 2002/2003 flights:	329,257 ac (133,251 ha)

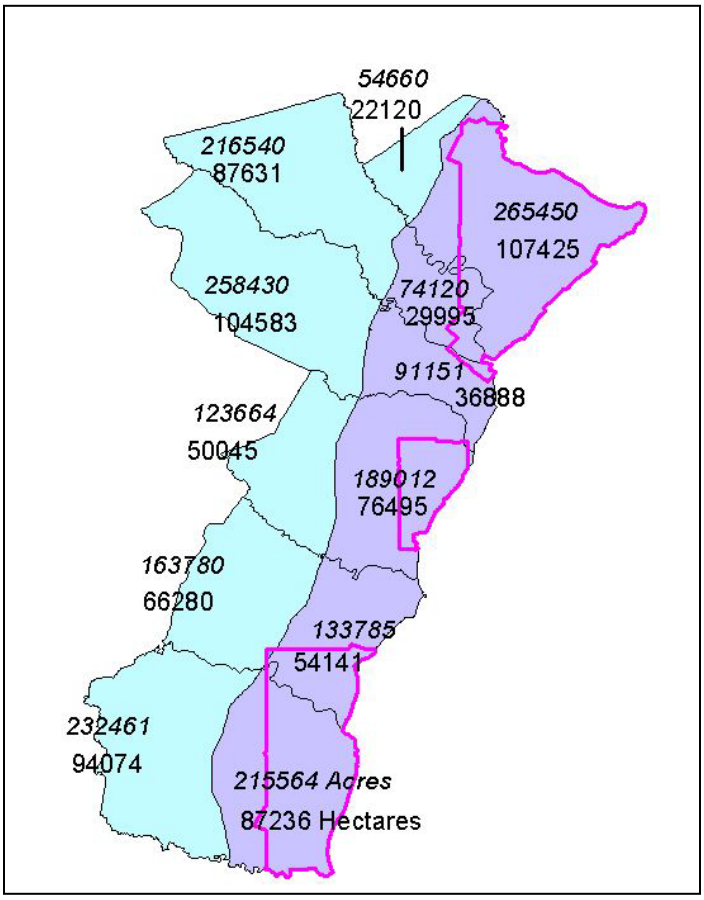

Figure 2. Area of first tier coastal counties east and west of I-95. Acres are italicized; hectares (km^2) are regular font. Pink outlines (no area given here) are those covered by the 2002-2003 NOAA photos, not including the areas covered by the estimated 150 photos for which we don't have a photo index.

Satellite imagery

Based on image specifications and cost per hectare, I would suggest that if we go this route, we should call for availability and package pricing to obtain images from IKONOS (1 m ARCHIVE imagery [older than 6 months], rectified and geometrically corrected – approximately $7/hectare). Standard delivery time for IKONOS products is 120-150 days.