Central Coast GIS User Group
5/12/2014

Minutes

Attendance: Eli, Lee, Sandy, Timothy, Neal, Farhad , John, Scott and Pat

Presentation: Pat Clinton, from the EPA gave an interesting poster presentation. The topic was, "A Decade of Mapping Submerged Aquatic Vegetation using Color Infrared Aerial Photography: Methods Used and Lessons Learned" and it stimulated some interesting conversation about processes, working with aerial imagery at various tide heights and working with little field verification. The poster is attached.

Meeting business: Our Symposium by the Sea is tentatively set for this September or October, but the schedule is tight with other conferences. If we are to pull this off **we need to have an organizing committee of willing volunteers who have the time to pull it all together**. All positions are needed from Event Chair to finding presenters, food, programs, nametags, etc. But most importantly, we need a Symposium Topic.

If you are willing and able to contribute time to this effort please contact Sandy Gruber at sandyg@lincolncity.org as soon as possible. We must get this effort going early in June.

GeoTrivia: Lee had us in a geotrivia competition that was difficult, but hard fought. I do believe that Pat was the winner (although there were a lot of points left on the table). The questions will be added to this document when available.

Next Meeting: Wednesday, July 9th at the new offices of the
Devils Lake Water Improvement District
Oregon Coast Community College North Campus

Presenter: Meg Gardner – Oregon Coastal Management

GeoTrivia May 2014

Answers are on page 2 (don't peek!)

1. How many unique countries are generally recognized on this Earth?
    a.
2. Alphabetically (by name) what are the first and last countries on this list?
    a.
    b.
3. What is the population of the country with the lowest population?
    a.
4. What is the population of the country with the highest population?
    a.
5. Name the 5 countries with the lowest populations.
    a.
    b.
    c.
    d.
    e.
6. Name the 5 countries with the highest populations.
    a.
    b.
    c.
    d.
    e.
7. Name one of the top 10 countries for introverts (lowest density).
    a.
    b.
    c.
    d.
    e.
    f.
    g.
    h.
    i.
    J.
8. List the top 10 countries by land area.
    a.
    b.
    c.
    d.
    e.
    f.
    g.
    h.
    i.
    J.
9. What is the most common first letter for country names?
    a.

GeoTrivia May 2014

ANSWERS

1. 233
2. Afghanistan and Zimbabwe
3. 799
4. 1,359,821,465
5. Holy See: 799; Takelau: 1,135; Niue: 1,468; Falkland Islands (Malvinas): 3,017; Saint Helena: 4,244
6. China: 1.4 Billion; India: 1.2 Billion; U.S.:312 Million; Indonesia: 240 Million; Brazil: 195 Million
7. Greenland, Falkland Islands (Malvinas), Mongolia, Western Sahara, French Guiana, Namibia, Australia, Iceland, Suriname, Botswana
8. Russian Federation, Canada, U.S., China, Brazil, Australia, India, Argentina, Kazakhstan, Algeria
9. "S"

Thanks, Lee McCoy, for a fun and challenging game.

A DECADE OF MAPPING SUBMERGED AQUATIC VEGETATION USING COLOR INFRARED AERIAL PHOTOGRAPHY: METHODS USED AND LESSONS LEARNED

Patrick Clinton, David Young and David Specht

U.S. Environmental Protection Agency Office of Research and Development - NHEERL - Western Ecology Division

Pacific Coastal Ecology Branch

Newport, Oregon 97365

ABSTRACT

Annual color infrared (CIR) aerial photographs acquired annually between 1997 and 2007 were used to classify distributions of intertidal and shallow subtidal native eelgrass *Zostera marina* and non-indigenous dwarf eelgrass *Z. japonica* in lower Yaquina estuary, Oregon. The use of digitally orthorectified aerial photography acquired at extreme low tides enabled very high resolution imagery from 15 to 25 centimeter ground pixels. The use of false-color infrared film enabled a high contrast between submerged aquatic vegetation (SAV) beds and bare substrate not visible in true color (RGB) film. The initial success of this remote sensing method inspired similar efforts in nine Pacific Northwest (PNW) estuaries from Willapa Bay, WA to Humboldt Bay, CA (Fig. 1). Innovative techniques developed during the course of the project included a flight planning tool and a hybrid image classification methodology. The decadal study enabled the mapping of spatio-temporal patterns in the distribution of intertidal vegetation including an exponential expansion of the distribution of non-indigenous dwarf eelgrass *Z. japonica* in Yaquina Bay. The methods developed in this study are applicable for use with four band digital aerial photography.

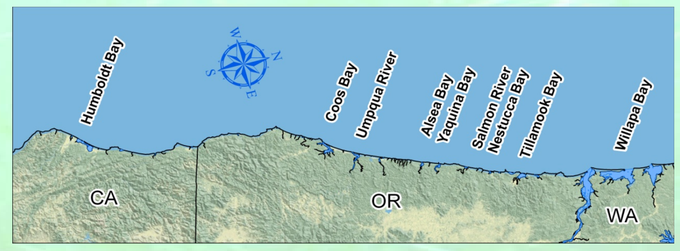
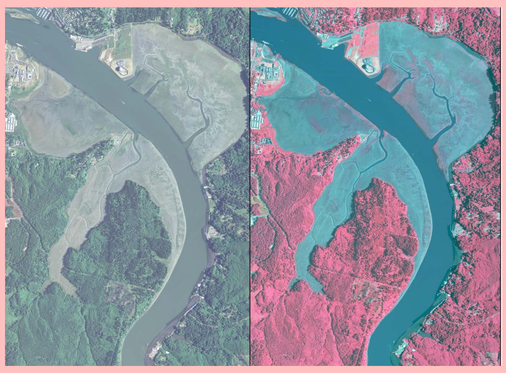


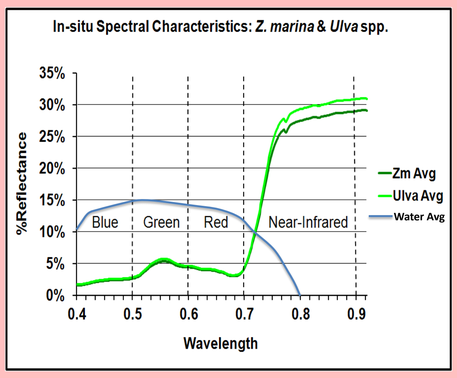
Figure 1. PNW estuaries where SAV has been mapped with the aid of CIR aerial photography since 1996. Eelgrass in Upper Newport Bay in Southern California was similarly mapped with the aid of CIR aerial photography .

Approach:
The Use of False Color Infrared Film

True color (RGB) vs false-color infrared (CIR)

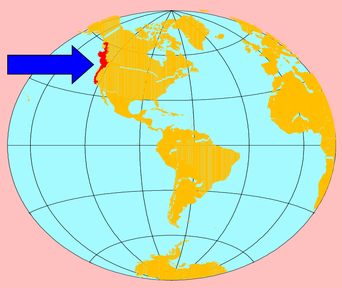


❖Although the accepted protocol for mapping SAV in 1997 from aerial photography was the use of RGB film, we chose to use CIR film.
❖SAV is clearly contrasted with open water and substrate in the false-color CIR imagery in comparison to the RGB.



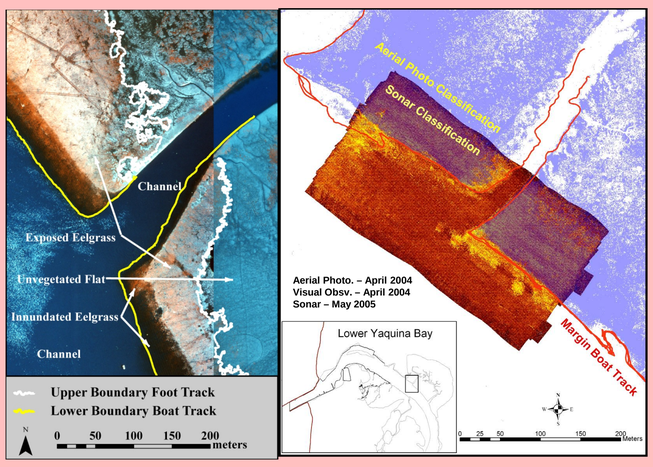
The use of CIR film for detecting SAV is counter-intuitive because:
❖Vegetation has strong reflectance properties in the Near - IR Band
❖Water has strong absorption properties in the Near - IR Band

The Pacific Northwest



Two factors enable the use of CIR photography for mapping SAV in the PNW <u>if acquired at extreme low tide</u>:
❖The relatively large tidal excursion maxima range (south to north is ~2m to ~4m).
❖The relatively shallow depth range of the indigenous seagrass, *Zostera marina*, in the turbid waters of drowned river valley estuaries.

Mapping the Lower Margin of Seagrass Beds in Yaquina Estuary



A comparison of Experimental Sidescan Sonar Classification, CIR Aerial Photography Classification,& In Situ GPS Observations demonstrates that the majority of eelgrass beds including shallow subtidal beds can be classified using CIR film acquired at extreme low tide.

Conclusion:

The Use of False Color Infrared Film to map intertidal and shallow eelgrass is appropriate in locations with large tidal ranges and turbid waters when acquired at extreme low tide.

Approach:
An Interactive Flight Planning Tool

A spreadsheet tool was developed to assist planning aerial photography with interactive "what if" capabilities.

Basic Formulae for Planning Aerial Photography

- Photoscale
  - *RF* = reference fraction
  - *H* = height above mean terrain elevation
  - *f* = camera lens focal length
- Flight Altitude
  - *e* = mean terrain elevation
- Ground Distance (lateral distance covered by a photo)
  - *D* = ground distance
  - *d* = film width
- Number of Flight Lines (*NL*)
  - *W* = width of study area
  - *Sg* = sidelap gain (100 – sidelap percentage)
  - *D* = ground distance
- Number of Photos per Flightline (*NP*)
  - *Og* = sidelap gain (100 – overlap percentage)

(Avery and Berlin, 1985)

$$RF = \frac{1}{H/f}$$

$$A = (RF * f) + e$$

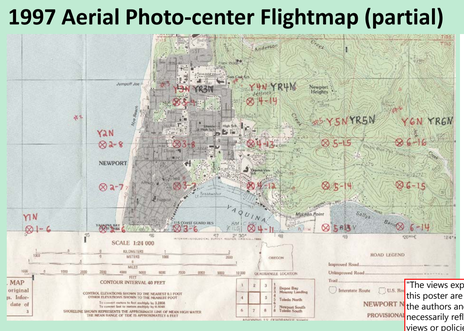
$$D = RF * d$$

$$NL = ciel\left(\frac{W}{D * Sg} + 2\right)$$

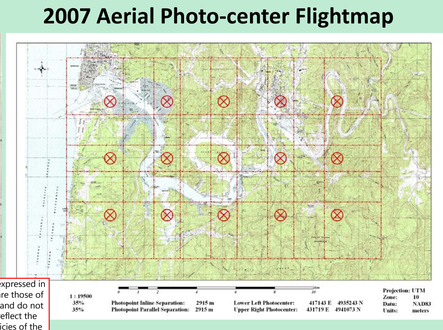
$$NP = ciel\left(\frac{L}{D * Og} + 4\right)$$

❖The basic formulae for planning aerial photography are based on geometries of the camera and aircraft altitude.
❖The formula share parameters which facilitated the use of a spreadsheet to explore our options.

1997 Aerial Photo-center Flightmap (partial)

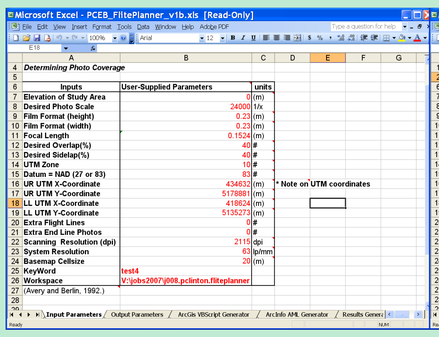


2007 Aerial Photo-center Flightmap

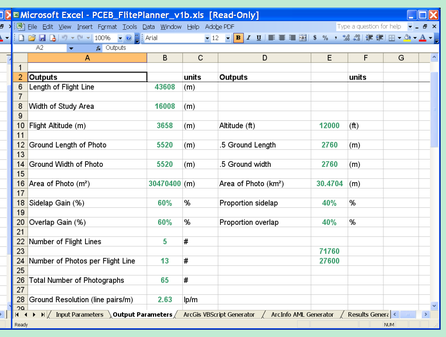


❖The 1997 flight map used four paper USGS Quad m… k 3 months to generate
❖The 2007 flight map was generated digitally and to… minutes to generate using the PECP Interactive Aerial Photo Flight Planning Tool

INPUT PARAMETERS SHEET

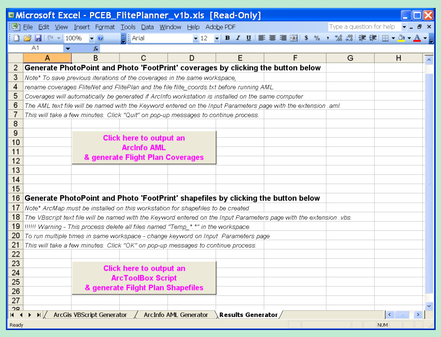


OUTPUT PARAMETERS SHEET



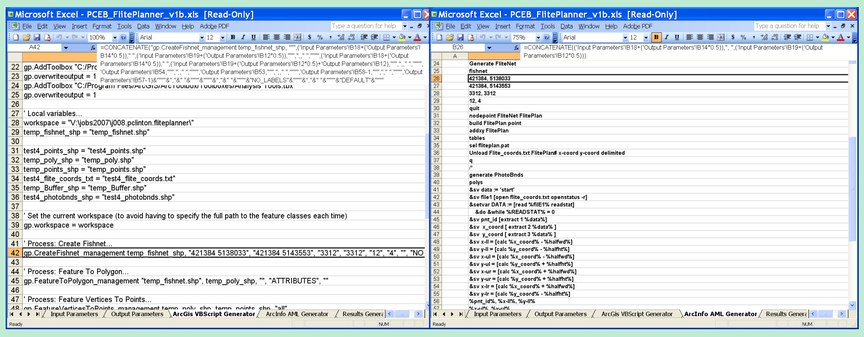
❖The PECP Interactive Aerial Photo Flight Planning Tool evolved from our initial basic formula spreadsheet.
❖Inputing parameters such as desired photoscale, lens focal length and scanning resolution produce output parameters such as number of flight lines and photos, ground width of photos and ground pixel resolution.

RESULTS GENERATOR SHEET



❖With a single click, an ArcInfo macro language (AML) text or ArcMap VBA script would be generated and executed by the geographic information systems (GIS) programs via a com procedure to create photo center points and photo footprint polygon coverages or shapefiles.

ARCMAP VBA SCRIPT **ARCINFO MACRO LANGUAGE (AML) SCRIPT**

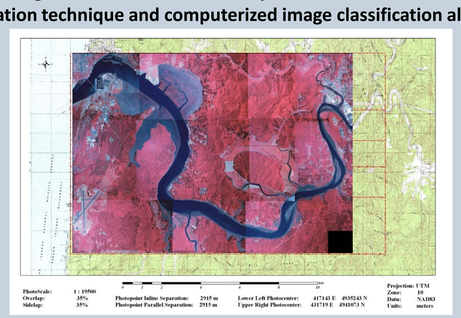


Conclusion:

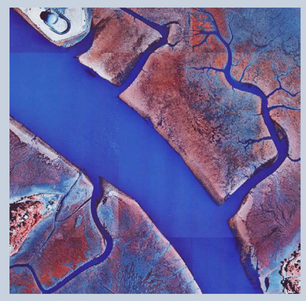
The OCEB Flight Planner was extremely useful and was used to plan the aerial photography of every major estuary in Oregon in 2005. However, MicroSoft no longer supports VBA scripting and ESRI (the makers of ArcMap) no longer support AML or VBA. Also the basic formula for planning digital aerial photography are likely to be quite different and varied depending upon the sensor. Major revisions are required to update this very useful tool.

Approach:
A Hybrid Image Classification Method

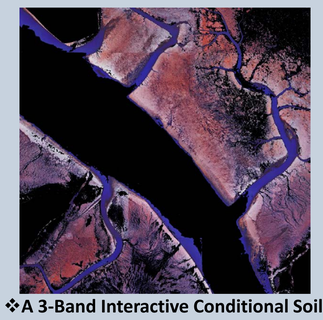
A hybrid method of image classification was developed that combines elements of human photointerpretation technique and computerized image classification algorithms .



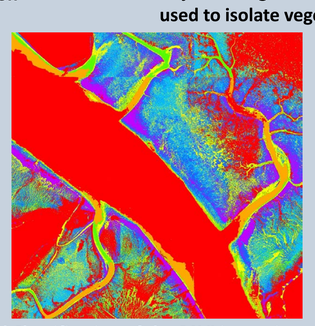
❖Photography was digitally scanned "Desktop Orthorectified" at 0.25m ground pixel resolution and mosaiced using ERMapper.



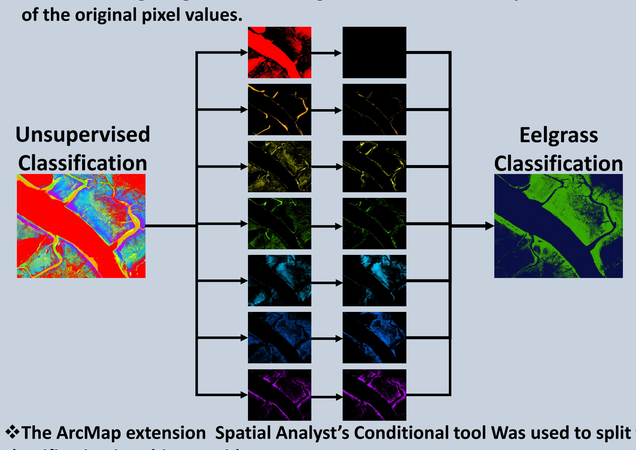
❖Aerial photo mosaic detail showing photometric variation



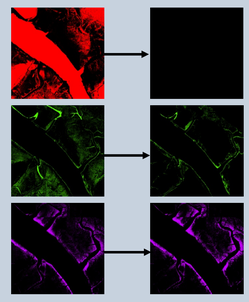
❖A 3-Band Interactive Conditional Soil Adjusted Vegetation Index (SAVI) was used to isolate vegetation in the image.



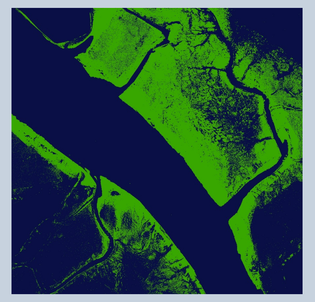
❖An Unsupervised Classification of the SAVI image into seven isoclasses using ERMapper was performed next.
❖The resulting image contained single values for statistically distinct clusters of the original pixel values.



❖The ArcMap extension Spatial Analyst's Conditional tool Was used to split the classification into binary grids
❖The ArcMap extension ArcScan was used for manual "Heads Up" editing of each individual binary grid to remove non-eelgrass pixels.



A detailed look at ArcScan "Heads Up" edits.



❖Compiled edits form eelgrass classification.

Conclusion:

This method combines the accuracy of human interpretation of spatial information with the precision of the computer processing of reflectance values resulting in highly detailed classifications. The method was successfully applied to digitally acquired half meter 4-band aerial imagery and remains a versatile and useful tool.

*Disclaimer: Mention of product name does not imply endorsement by the U.S.EPA