School Name: _____
Student Name(s): _____
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Remote Sensing (C)

Nebraska Science Olympiad
State Competition
University of Nebraska-Lincoln
Saturday, April 2nd 2011
Question and Answer Sheet
100 points total

Show all mathematical operations and answer all questions with complete sentences unless noted. Always use significant figures. Use the separate sheet with tables/figures to answer any questions referencing them on this answer sheet.

1) Name at least three types of greenhouse gases and four sources of these gases. At least one example must be from a non-anthropogenic source. (10pts)

2) Provide at least two causes for sea level rise when global temperatures rise. (6pts)

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3) Table 1 is a grid radiance values taken from a layer of a satellite image. Assuming the highest value is 100% reflectance and the lowest value is 0% reflectance, complete the table on your answer sheet. Provide the work solving for at least 1 number in the grid. You do not need to answer in complete sentences for this question (6pts: Part of this question will be used as a tie breaker).

0%	
	100%

4) What is the difference between active and passive sensors? Provide at least 1 example of each type (6pts).

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5) In a LandSat 7 image, which bands would be used for a true color and false color image? Indicate which band would represent which color for both images. (6pts)

6) NDVI is defined in Eq. 1. Calculate NDVI from the spectral response of a pixel in Table 2. You do not need to answer in complete sentences for the question. Part of this question will be used as a tiebreaker (6pts)

Eq. 1: (NIR-Red)/(NIR+Red)

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7) Using Fig. 1, near what other land cover type is agriculture typically found? Which land cover type has grown the most between 1973 and 1997? Second largest growth? Which land cover type has shrunk the most over this watershed? Between which images did the most change occur? (10pts)

8) Which satellite platform(s) is/are least sensitive to cloud cover? Why? (4pts)

9) Using Fig 2., as of 2004, where is most of the Hemlock Wooly Aphid infestations currently located? If we assume that this species needs the presence of Hemlock to spread within 5 counties, are any regions currently safe from infestation? Provide a scientifically sound reason why there are isolated infections of the Hemlock Wooly Aphid (e.g. infected county surrounded by uninfected Hemlock). (6pts)

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10) Using Fig 3., what process in the hydrologic cycle individually involves the largest volume of water? As global warming increases the surface temperature of the earth, it will increase evaporation and transpiration rates. What must happen to balance out this increase? (6pts)

11) If global CO_2 increases but temperatures do not change, what will have to a plant's transpiration rate? If CO_2 is stable, but global temperature increases, what will have to a plant's transpiration rate? (4pts)

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12) Using Fig 4., where in the USA is fire potential the highest on 8/6/08? Why does this area have a higher risk potential? Why might the USFS not provide a fire potential for agricultural areas (e.g. Most of IL, IN etc.) (6pts)

13) Using Fig. 5, why is the reflectance of water essentially zero around 0.8 μm? At this same region healthy vegetation has high reflectance, what are some reasons that a healthy plant will reflect more in this region over the red region ~0.67 μm. (6pts)

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14) Using Fig. 6 and Fig 7, is Europe most likely experiencing a heat or cold wave in July of 2003? Approximately what is the difference between 2003 and the averaged 1982-1998. (Hint 273K = 0 °C). Are there any other areas with extreme differences between the two figures, if so, what are they and in which direction is the difference. Part of this question will be a tie breaker. (8 pts)

15) Subsidence is the process of which earth settles to a lower elevation. Fig. 8 and Fig. 9 demonstrate subsidence located near several mine shafts (indicated by the red and white lines). Why might managers of mining operations be interested in figures such as these? How many areas are affected on 8/14/07, 12/30/07? In units of area, how much as the largest subsidence grown from these two dates. You may approximate by estimating each area as a known polygon (please indicate which polygon utilized to ensure accurate grading). (8 pts)

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16) Due to the devastation of natural disasters, such as the one in Japan on March 11th, 2011, there is a rush to capture and develop before and after images, such as Fig. 10. While these images can be useful to indicate areas affected by the disaster, list and describe at least 3 potential problems associated with these types of images (e.g. how might someone misinterpret information from the before and after images, etc.) (6pts)

17) Fig. 11 shows an impervious land surface map. Why are city planners interested in such maps? What is the primary driver for increasing impervious surfaces? How much city planners mitigate some increases in impervious surfaces? (6pts)