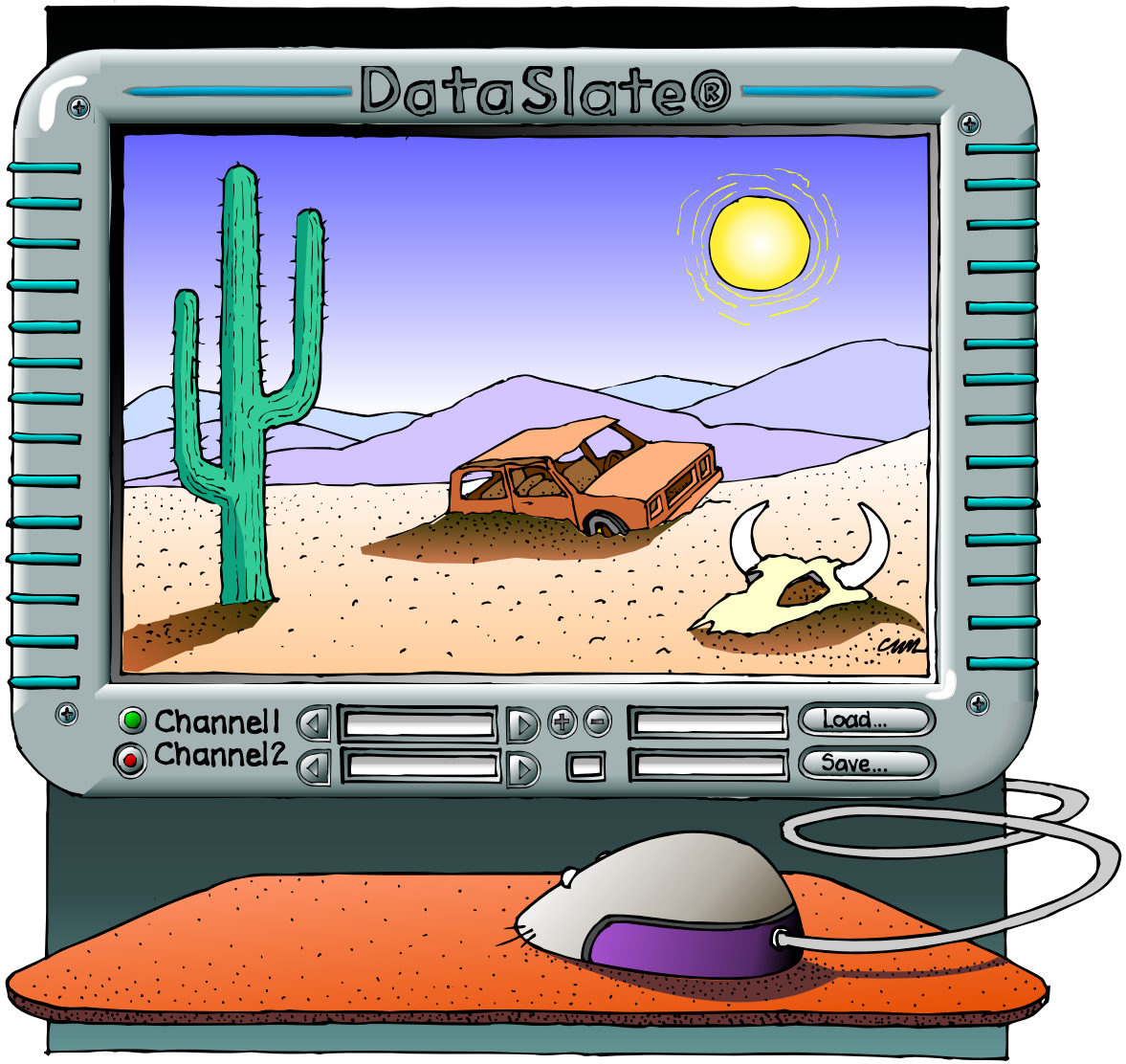
Educational Product	
Educators	Grades 9-12

The Potential Consequences of Climate Variability and Change

The Great American Desert?

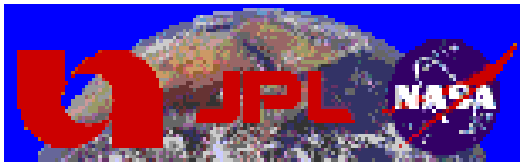


AGRICULTURE

Teacher Notes

Climate Change

Great American Desert???



Suggested Curriculum Areas:

Science ... Math ... Social Studies ... Language Arts

Suggested Grade Level:

9-12

Learner Outcomes

- Students will be able to define Global Change.
- Students will become aware of the effects of global warming on grasslands.
- Students will be able to use satellite imagery to develop a plan for testing various types of grasses in different areas of a grassland.
- Students will use a spreadsheet to develop a plan for planting a test plot in a grassland.
- Students will develop a hypothesis about testing grass growth.

Concept Introduction

Students will assume the role of an agronomist. Students receive information about climate change and its possible effects on grasslands in western Nebraska and eastern Colorado. Students will examine data related to temperature change, examine satellite imagery of Garden County Nebraska, and examine different varieties of grasses. Students will then develop a hypothesis and an experiment to test it. Students will present their hypothesis to the class.

Student Page(s)

Tools:

- DataSlate

Data Sets

- Garden County Nebraska (zip file 1.8 MB)
- Seed cost spreadsheet template (zip file 1K)

Tutorials:

- Introduction to DataSlate

Teacher Preparation

Technology

The lesson will cover about one 50 minute period. Teachers need to be familiar with DataSlate and its basic operations. The on-line tutorial is available for teachers to become familiar with the software. Teachers need to also be able to decompress compressed zip files. Ability to enter data into a spreadsheet is also necessary. Browsers need to have the Real Player plug-in installed. The computer used should be at least a Pentium 90 (166 is better) with 16 MB of ram or a Power Macintosh with 32 MB of ram. Either platform needs a CD-ROM.

Background

A recent study indicates that global warming has caused a problem for western grasslands. Daytime high temperatures do not seem to be the problem. Night time highs are the problem. It's during late winter and early spring that the problem occurs. Night time highs have risen and the last frost date occurs an average of two weeks earlier than it had twenty years ago. Native grasses now germinate too late. Noxious plants instead germinate early and deplete the moisture in the soil as well as compete for other resources needed by the grasses. To compound the problem, cattle do not graze on the weeds. Students will be asked to develop an experiment that will allow ranchers to adapt to this change. They will examine various types of grasses to supplement the native grasses. They will examine a variety of grasses, compare costs and calculate the cost conduct the experiment. This is an excellent activity for cooperative groups. Students will develop a persuasive presentation to present to a group.

Curriculum Standards:

National Mathematics Standards

• NCTM 9-12 Standard 1: Problem Solving
• NCTM 9-12 Standard 4: Mathematical Connections

National Science Education Standards

• NSES 9-12 Content Standard: Earth and Space Science
• NSES 9-12 Content Standard: Science in Personal and Social Perspectives

National Social Studies Standards

• NCSS Strand VII: Production Distribution and Consumption
• NCSS Strand VIII: Science Technology and Society

Assessment Suggestions

- Peer review as part of writing process for document/presentation
- Observe student projects for good control of variables and value of hypothesis

Resources

Teacher Talk Global Change
The Seed Shop
Real Audio Broadcast from NPR
(Requires Real Player)

Lesson

Introduce the concept of climate change to students. Discuss possible effects of global warming. Assign students to cooperative groups. Tell students that they will be reviewing information about a recent study on climate change and grasslands. Inform the students that they will need to develop a hypothesis and an experiment to test the information they received. They will not need to conduct the experiment, however they will need to present their hypothesis to the class. Give the students time to work at the computers.

Concept Extensions

- Grow the grasses in a test plot to determine the value of each grass
- Allow students to develop their own spreadsheet
- Students contact agronomists and find out more about testing new varieties of plants.
- Students find out more about genetic engineering.
- Students recreate charts using raw data from article.

References

http://ois.unomaha.edu/casde/bblocks/, last modified 1/14/99, UNOmaha Office of Internet Studies

Great American Desert???

Activity:

You will assume the role of an agronomist, an expert in soil management and field-crop production. You have just heard a news broadcast about the effects of Global Warming on grasslands and want to investigate further. Your task is to examine a grassland, select an area for study and examine various seed varieties for their ability to adapt to climate change. You will develop a hypothesis, develop an experiment and present your it to your peers for review.

Real Audio Broadcast from Morning Edition, NPR Radio

(Note: Requires RealPlayer)

Procedure:

1. Listen to the Real Audio Newscast for background information. This is the newscast that will cause you to develop an experiment.

2. Your team now needs to collect some background information. To do this you will need to pick an area of grassland to be studied. You should pick an area that is representative of a grassland. It should not have other activities happening in it. For example it should not have other agricultural activity or communities. The area you choose will cover a one acre plot.

- **Launch** DataSlate and open the file called GRAZE.lbl. This is an image of Garden County Nebraska. You will select your test area from this location.
- Click on the right arrow once to see some possible areas to develop a test plot. Remember that you can zoom in at any time by clicking the + button or zoom out by clicking the - button.
- Click the right arrow once more and the image will change to the same area with labels describing the area.
- Click on the title of the image and a text file will be displayed describing the images.
- Return to the images and click the red channel two button. A window will open in the image displaying one of the other images. Clicking the right arrow beside channel two will change the window image. This allows for the viewing of two images at the same time.
- Use these tools and select an area for your test plot.

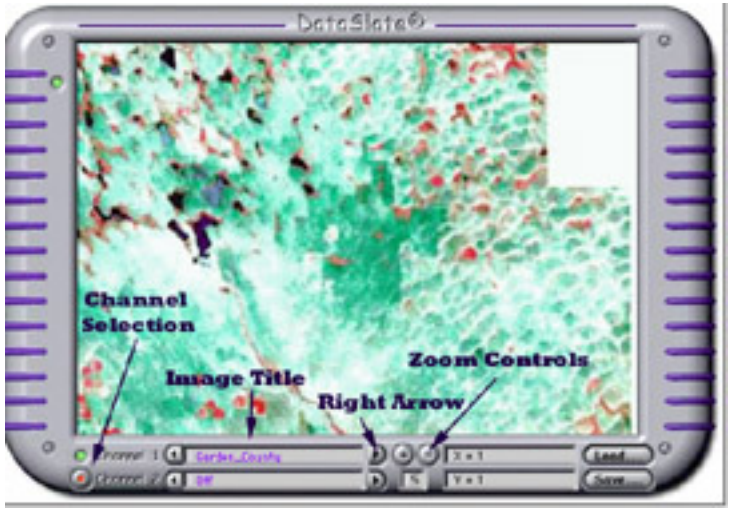
  Be sure and take notes on what you observer on
- each of the areas.

3. Now you need to study various type of seed or seeds you would like to use for your experiment. Click on Grass Seed Chart and you will be able to view several types of grass seed, cost, and applications rates. Study the types of seed and become familiar with them. Be sure and take notes on the types you observe.

4. After studying the data above you need to develop a hypothesis about what seed types will do well on the land which you will test. This hypothesis should be written in a document, which should be reviewed by peers for both content and mechanics. Document should include:

- background information on the problem.
- how proving your hypothesis might contribute to solving a potential problem.
- reasons for selecting the area you choose.
- seed cost for the experiment. Open the spreadsheet template in your spreadsheet program and create the spreadsheet needed to calculate seed cost.

5. You will present your experiment plan to the class for review. You may choose to create either a html, Power Point or HyperStudio presentation.



Connect to DataSlate Tutorial

Grass Seed Chart

Data Slate

A Tour with Data Slate

Launching Data Slate: To launch data slate, open the program folder and double click on the application. The program will launch and run opening to the screen below. This tutorial is designed to give you basic information about Data Slate. To use this tutorial simply click on an area of the Data Slate picture. A description of what that area does and how to use it will appear in the window to the right.

Data Slate is a JPL produced tool which is designed to show co-registered and layered images. This image shows the selection library for the current version.

Some data sets have comments on remote sensing, in addition, there are useful 'Remote Sensing Tutorials' on the 'First' CASDE CD. The tutorials may be helpful in analyzing these data sets.

Data Sets: These are the standard data sets that can be used on the current version of Data Slate. To use a set simply double click on that data set and one of the images will be loaded into channel one of the Data Slate window. Future versions of Data Slate will allow you to develop and use your own sets of images.

Description of Data Sets

The Current Data Slate Library

Ares Vallis

Panorama - A panoramic view of the local Martian landscape. Find the image which annotates the rock 'names'. Get out your 3-D glasses for 'three-D'! How is this image prepared?

Safsaf Oasis

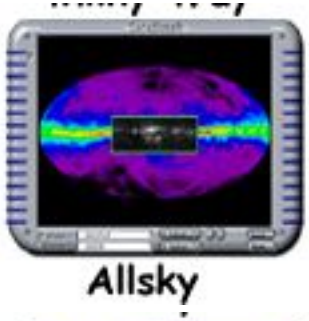
SIR-C - Click on the title for information about the data sets. These are Landsat and SIR-C images. SIR-C is an acronym for Spaceborne Imaging Radar on C band (6 cm). Check on the Radar Tutorial from JPL for more detailed information on radar imaging. The full tutorial resides on CD's 'SIRCED01 and 02' SIR-C Education Program CD's from JPL. More information on SIR-C and Imaging Radar may be found at:

http://southport.jpl.nasa.gov

Milky Way

When you click on different wavelength interrogations, we are reminded of how little the ordinary eye is able to detect. How much of the electromagnetic spectrum is made up of the visible light section?

Go Back



All Sky

The 'information' screen tells us that posters are available.

Jupiter

A very active atmosphere.

Cuprite, Nevada

Some great comments on remote sensing! Read how minerals are observed and detected by remote sensing.

San Gabriel Mountains

It might be interesting to follow the San Andreas fault line through the image.

Go Back

Pasadena

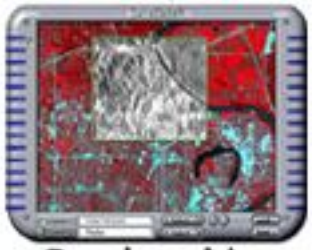
Find the Rose Bowl!

Grand Island, Nebraska

Again, there is more information on remote sensing.

Alma, Nebraska

Find Alma in all of the images. Alma resides on the North shore at the upper end of the lake. Note that Republican City has moved!



Omaha

Page one of this tutorial describes locating some some landmarks in the images. The TM3 band gives a good look at Eppley Airfield. Try overlaying the 'dem' with radar to see the Mormon Bridge area. Perhaps you can see by the terrain why some western migration crossings were done here.

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Selected Grass Seed Types:

Type 1: Grasslands Zero Nui Perennial Ryegrass: A New Zealand ryegrass and known as the best all-around for dairy, beef and sheep grazing pasture on farms with good soil fertility and moisture. Excellent for intensive grazing. Early maturity. Aggressive. Fair winter hardiness. Good for no-till drilling. Seeding rate: 30#/acre. 55#/bag. $1.55/lb.

Type 2: Barenbrug Super Perennial Ryegrass Blend: A one of a kind mid-late maturity perennial ryegrass blend of winter hardy diploid perennials. It is high producing, persistent and the most winter hardy of perennial ryegrasses. For dairy, beef and sheep pasture grazing. Seeding rate: 30#/acre. 33#/bag. $1.75/lb.

Type 3: Grasslands Matua Prairie Grass: A very useful new forage. Tested and highly rated by many university trials. Heavy producer. Best utilizer of surplus nitrogen, perfect for confinement dairies, hog and chicken farms and sewage plants. Heat/drought tolerant. Fair winter hardiness. Seeding rate: 30-40#/acre. 44#/bag. $1.75/lb.

Type 4: Barenbrug Stockmaster Pasture Mixture: A mixture of fine leaf perennial ryegrass, grazing type tall fescue and a grazing-type orchard grass. Great choice for non-irrigated beef, sheep, and horse pastures on sites with less than ideal soil moisture & fertility, pH and drainage and run under less than ideal grazing management. Seeding rate: 25#/acre. 50#/bag. $1.60/lb.

Type 5: Barenbrug Barcel Tall Fescue: A Holland bred variety unique for its high digestibility and palatability. Soft, smooth leaves with low shear strength make it an excellent variety for grazing, alone, or together with perennial ryegrass. Seeding rate: 35#/acre. 50#/bag. $1.75/lb.

For more information on these seed types, try examining the web site for Modern Forage Systems, Inc.
http://www.modernforage.com/seedshop.htm

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http://ois.unomaha.edu/casde/bblocks/, last modified 1/14/99, UNOmaha Office of Internet Studies

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References

Alward, R. D., Detling, J.K., & Milchunas D. G.(1999). Grassland vegetation changes and nocturnal global warming. Science, 283, 229-231.

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