

P1: Green-up Cards



Purpose

To recognize patterns of green-up at the plant, landscape and regional scales

Overview

This activity is to prepare students to recognize what a bud looks like and the progression of green-up from the time of budburst. Students will arrange plant growth pictures taken from the bud, shrub canopy, grass clump, landscape and regional perspectives.

Student Outcomes

Students will recognize temporal (over time) progression of green-up at the bud, shrub canopy, grass clump, landscape and regional spatial scales.

Science Concepts

Earth and Space Sciences

Seasons result from variations in solar insolation resulting from the tilt of the Earth's rotation axis.

Physical Sciences

Sun is a major source of energy for changes on the Earth's surface.

Life Sciences

Earth has many different environments that support different combinations of organisms.

Organisms' functions relate to their environment.

Organisms change the environment in which they live.

Plants and animals have life cycles.

All organisms must be able to obtain and use resources while living in a constantly changing environment.

All populations living together and the physical factors with which they interact constitute an ecosystem.

Populations of organisms can be categorized by the function they serve in the ecosystem.

Sunlight is the major source of energy for ecosystems.

The number of animals, plants and microorganisms an ecosystem can support depends on the available resources.

The population of an ecosystem is limited by its resources.

Energy for life derives mainly from the sun.

Living systems require a continuous input of energy to maintain their chemical and physical organizations.

The interaction of organisms in an ecosystem have evolved together over time.

Scientific Inquiry Abilities

Observing patterns at different scales

Ordering observations

Use appropriate tools and techniques.

Time

One class period

Level

All

Materials and Tools

Green-up cards

GLOBE Student Science Log

Preparation

None

Prerequisites

None



Background

This activity is to help students know what to look for when they start the Green-up Protocol observations which will provide ground verification of remotely sensed images. This will also help students appreciate the variety of spatial scales at which green-up occurs. To help prepare students for the *Green-up Protocol*, pictures of green-up and leaf growth are provided. By using Green-up Cards, they will identify green-up patterns at the bud, shrub canopy, grass clump, landscape, and regional (remotely sensed) spatial scales.

Spatial scale refers to gradations of area size (from square centimeter to square kilometer) of space viewed. Each scale is a foundation for the next scale, as can be seen in the table below.

Trees/ Shrubs	Grasses
Bud	Grass blade
Branch	
Tree/Shrub	Grass clump
Community	Grass field
Region	Region

Unique patterns of green-up can be observed within each scale and the patterns within scales are related. Buds (small, hard, protective structures containing miniature leaves formed every year by trees and many other plants in preparation for the next growing season), though seemingly small and insignificant, become more important from a global perspective related to green-up as the scale increases to regional spatial scale. Regions are composed of landscape units. Landscapes are composed of shrub and tree communities, and grass fields. At the landscape scale, migrations of waterfowl, songbirds, mammals and other wildlife are connected to the patterns of green-up. Green-up is important for the ecology of these organisms because it indicates availability of favorable conditions to provide food and shelter for these migratory animals. At the

regional scale, scientists are using satellite images to observe green-up and to make greenness maps for use in assessing fire danger in savanna areas of Australia, Africa, and the United States. High greenness areas represent lower wildfire danger, while low greenness areas represent higher wildfire danger.

What To Do and How To Do It

Getting Ready

- To help understand students' thinking before the activity, ask students what a bud is and why they think buds are important in green-up.
- Ask students why they think observing green-up is important.
- Ask students in what other spatial scales green-up occurs besides the bud level, and why they think the different scales are important.
- Ask students what factors might be important in initiating green-up (warmer temperatures, increased soil moisture, etc.) and why they think so.

Exploration

- If there are not enough sets of green-up cards so that each student can have a set, have students get into groups.
- Pass out a set of green-up cards for each group.
- Ask each group to arrange the green-up cards in an order that makes sense to them to show progression of green-up with time (from beginning of green-up to leaf maturity) and at different spatial scales: bud, shrub/tree, grass clump, landscape, and regional (remotely sensed). Tell them to be prepared to talk about what they did.

Generalization

- Ask students to share what they did and why.
- Ask students what they understand about spatial scale

- Ask students to discuss importance of observations on smallest scale, e.g., bud or grass blade level.

Assessment

1. GLOBE Student Science Log
Have students write and/or draw in their logs about
 - What a bud is and why they think buds are formed.
 - Why observing and recording green-up is important.
 - At what scales green-up occurs and the importance of the different scales.
 - Have each student predict the date that green-up will occur this year at their school study site and explain why he/she chose the date. (Is it based on environmental factors that bring about green-up?)
2. Have students arrange green-up cards to show progression of green-up over time (from beginning of green-up to leaf maturity) and at different spatial scales: bud, shrub canopy, grass clump, landscape, and regional (remotely sensed).

The card sets with examples of different spatial scales are in the following figures.

Examples From the Bud Scale

Aspen :

- Cards A
- Card B
- Card C
- Card D
- Card E

(photographs with line drawings)

Birch :

- Cards A
- Card B

Card C (photographs with line drawings)

Willow:

- Card A
- Card B
- Card C
- Card D

(photographs with line drawings)

Examples from the grass clump scale:

- Card A
- Card B
- Card C

(photographs and line drawings)

Examples from the shrub canopy scale:

- Card A
- Card B
- Card C

(photographs and line drawings)

Examples from the landscape scale:

- Card A
- Card B
- Card C
- Card D

(photographs and line drawings)

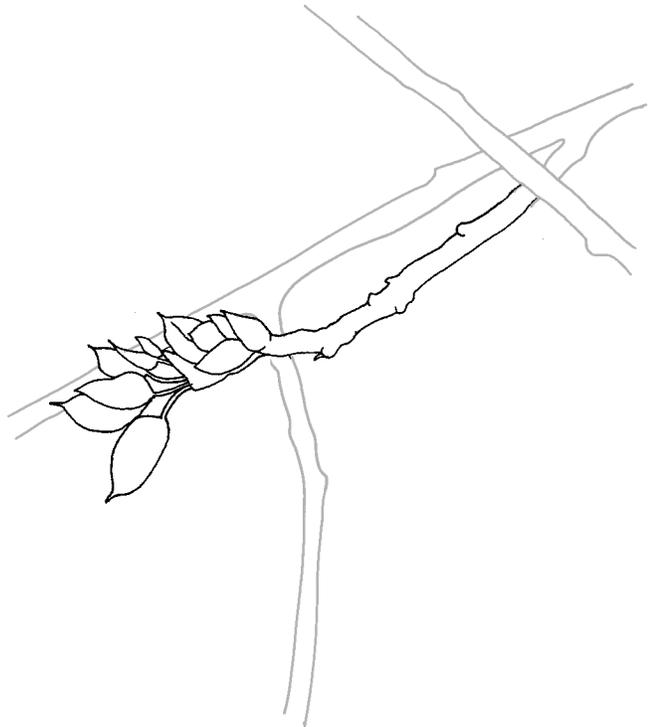
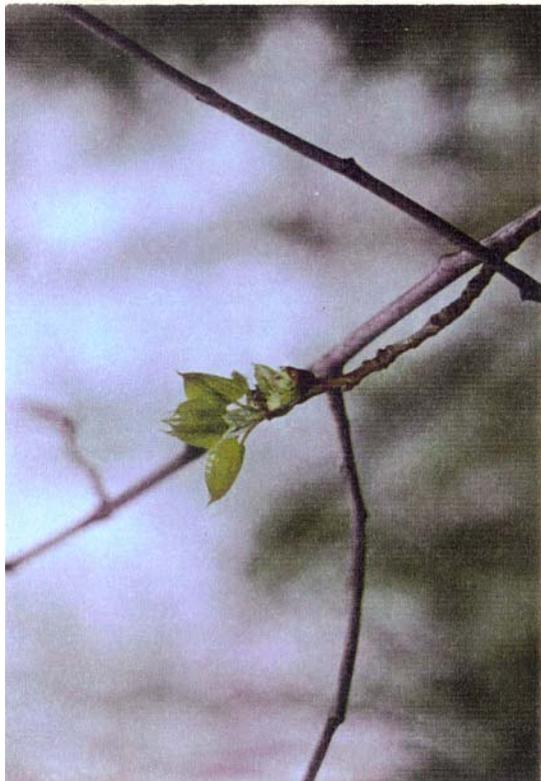
Examples from the regional scale:

- Card A
- Card B
- Card C
- Card D
- Card E

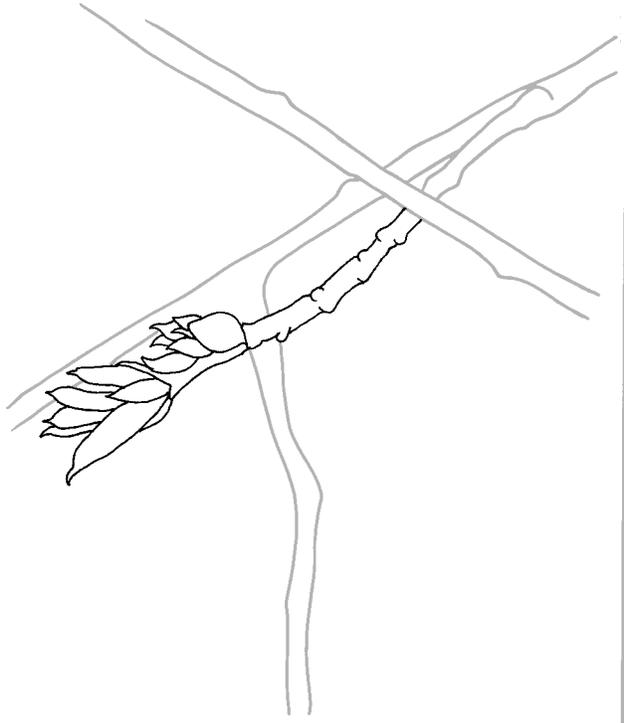
Aspen B



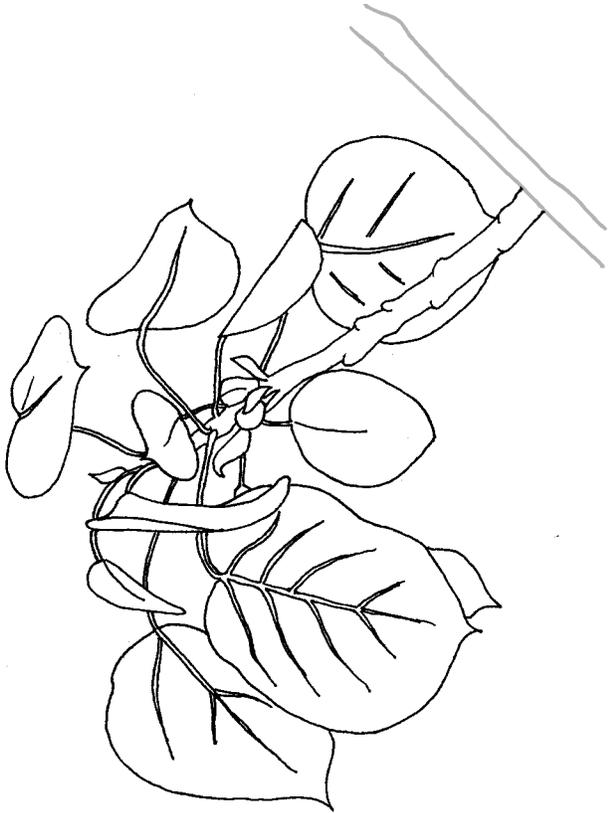
Aspen A



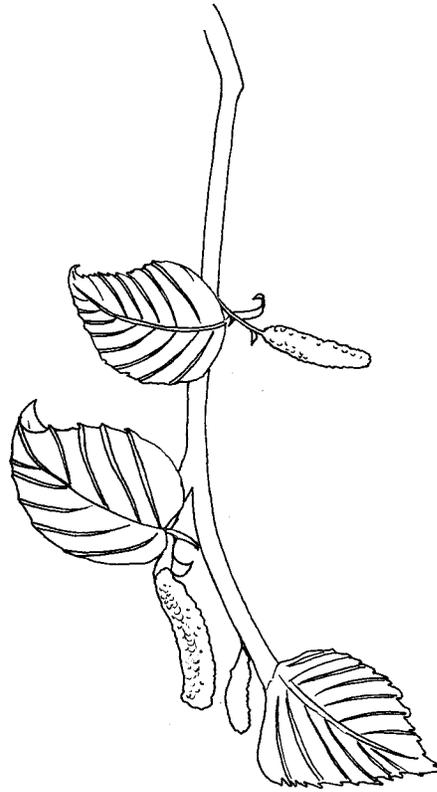
Aspen D



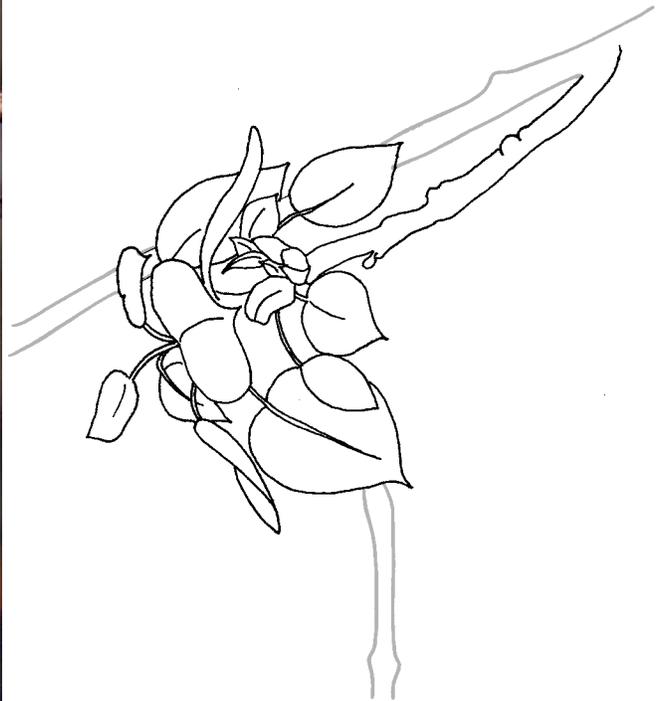
Aspen C



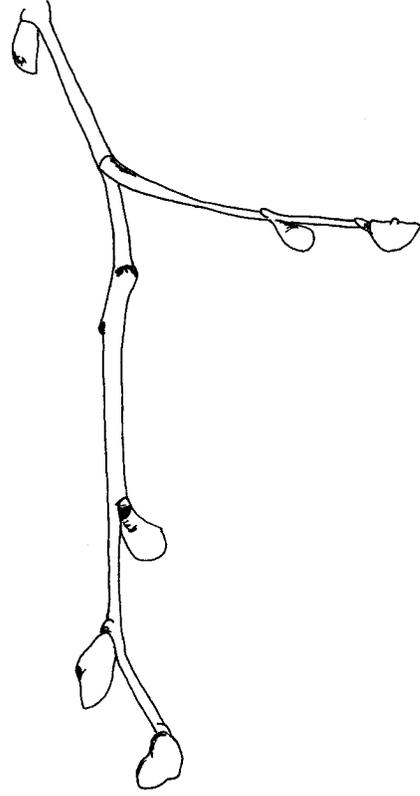
Birch A



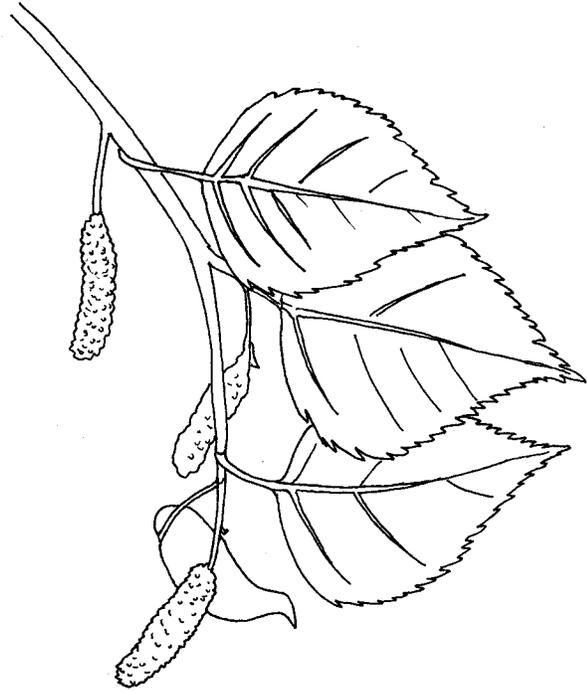
Aspen E



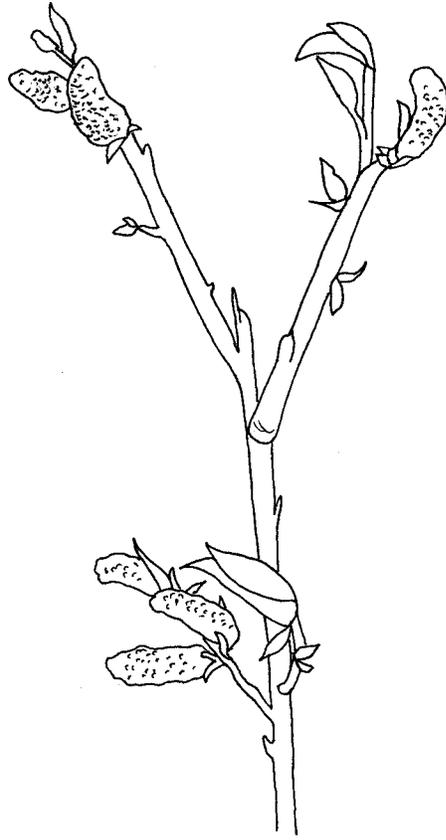
Birch C



Birch B



Willow B



Willow A



Willow D



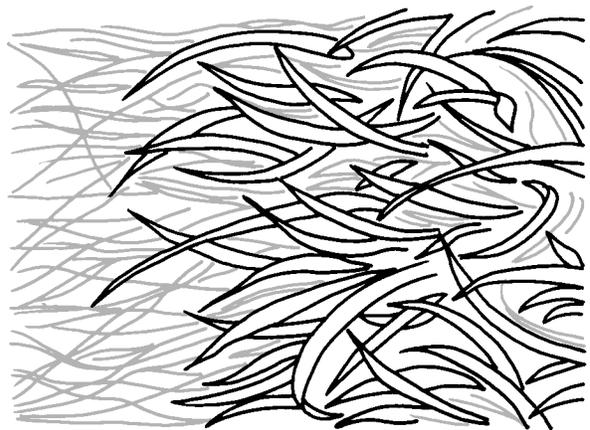
Willow C



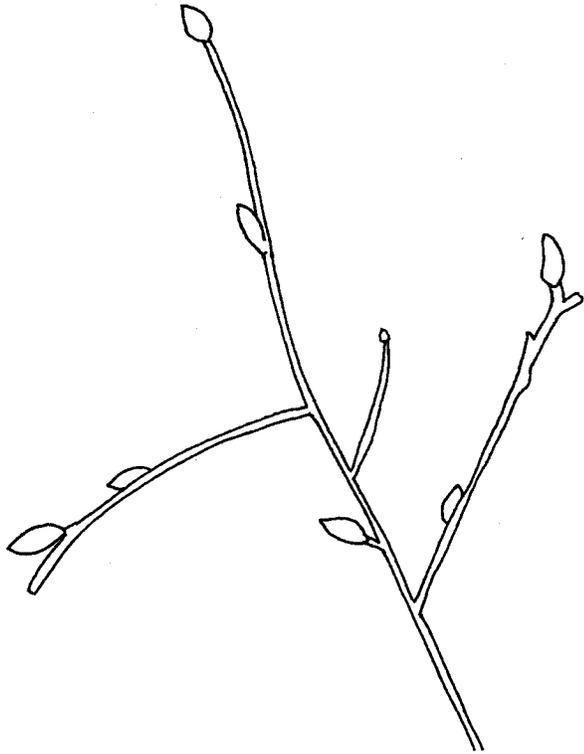
Grass Clump Scale B



Grass Clump Scale A



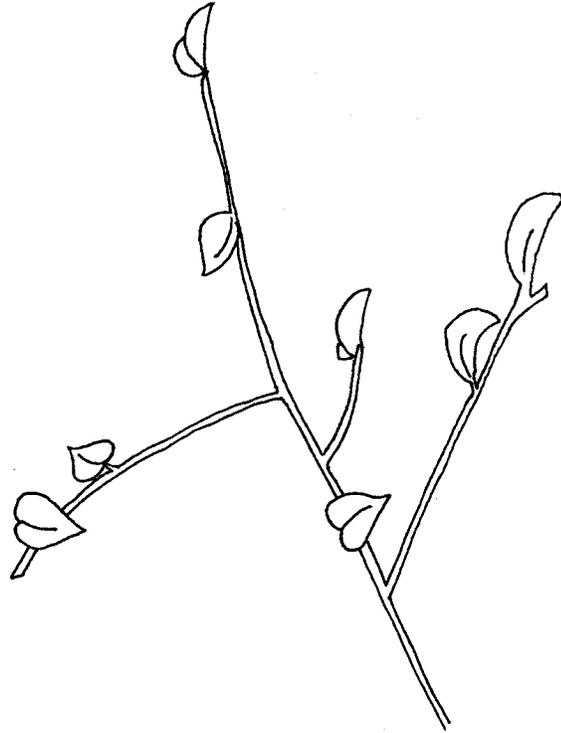
Shrub Canopy Scale A



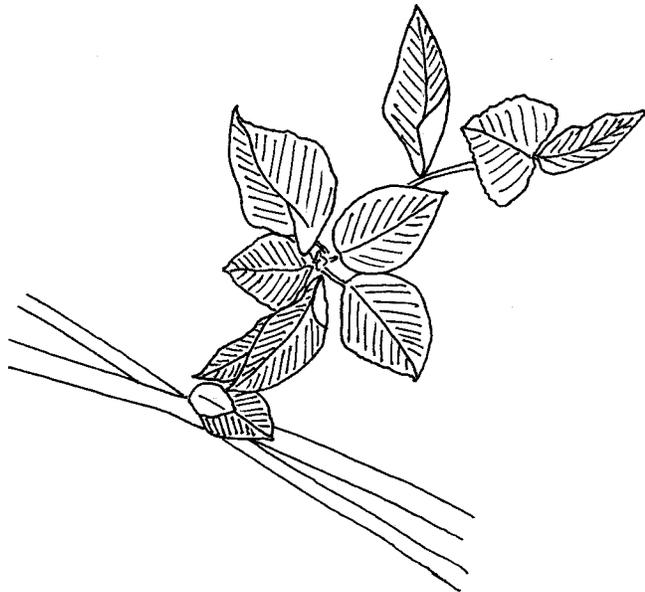
Grass Clump Scale C



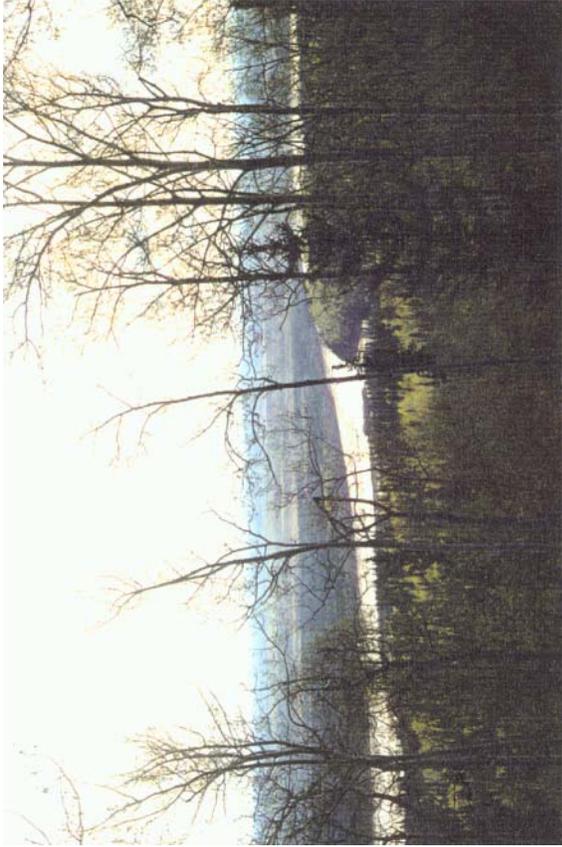
Shrub Canopy Scale C



Shrub Canopy Scale B



Landscape B



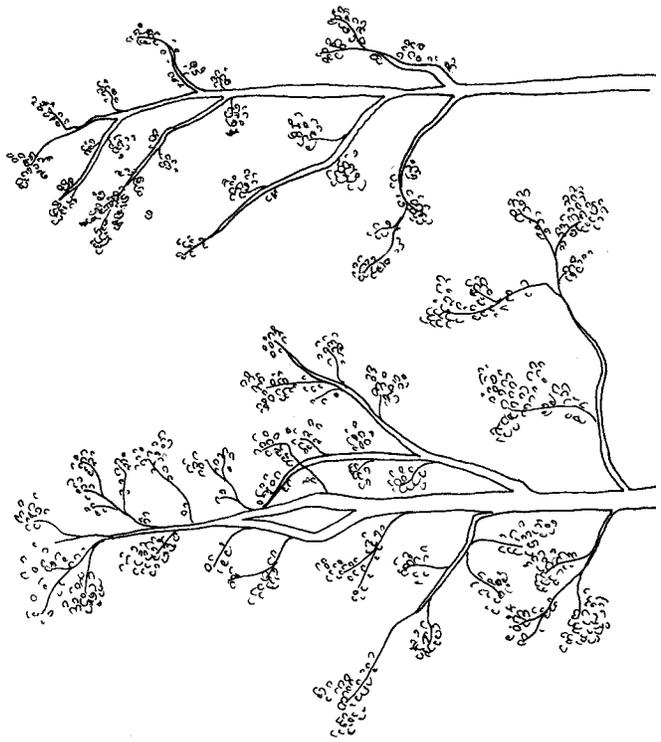
Landscape A



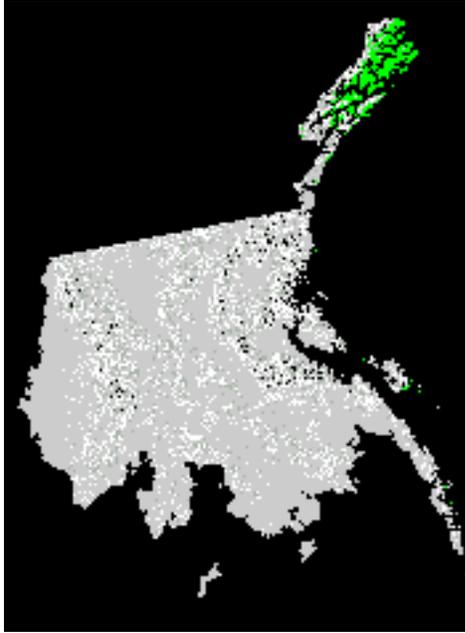
Landscape D



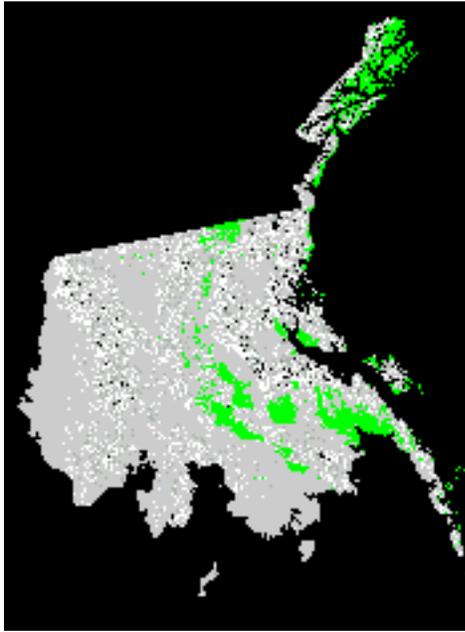
Landscape C



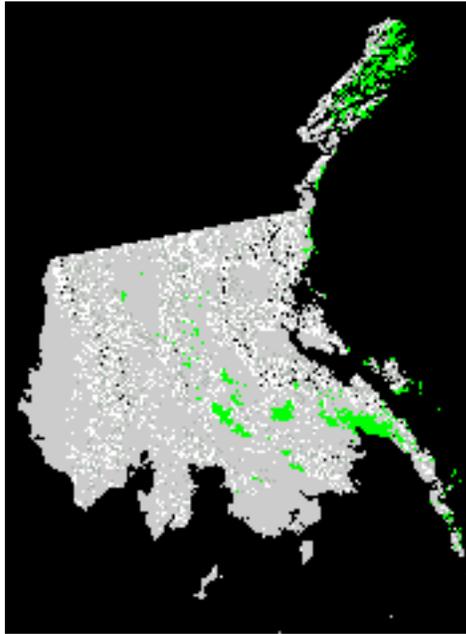
Regional Scale B



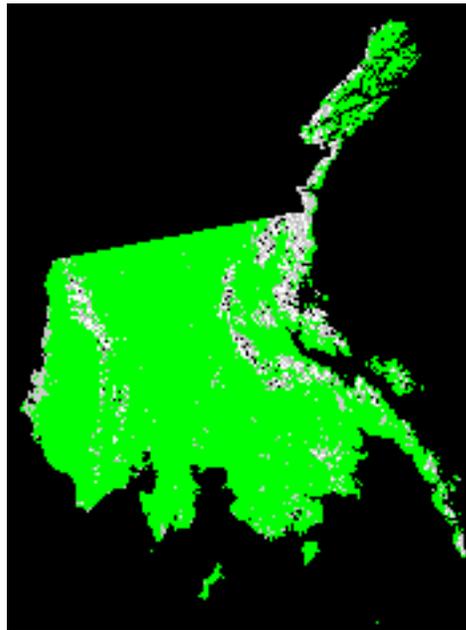
Regional Scale A



Regional Scale D



Regional Scale C



Regional Scale E

