Fire and Ecological Disturbance

Directions: Take the True of False pre-assessment below. Then read the information in Figure 1, and examine the data in Figure 2 and 3. Use the data in Figures 1-3 to answer all of the questions on page 4. Go back and re-take the True or False assessment.

True-or-false p r e - assessment.

Fire in Pinelands	Circle one
1. Fires kill all of the wildlife in the wetlands.	T F
2. Some plants have adapted to survive and thrive with fire.	T F
3. Prior to the settlement of North America, lightning caused most fires.	T F
4. High-intensity fires are always ecologically destructive and bad.	T F
5. When fires occur regularly, the heat sterilizes the soil and kills most of the plants.	T F
6. Some wetlands historically burned as often as every one to three years.	T F
7. Many of our wetlands are less healthy because of reduced amounts of fire.	T F
8. Fires can increase the diversity of the vegetative landscape and foster a mosaic of habitats.	T F
9. Ecological communities always succeed from grasses to shrubs to trees.	T F
10. Fire recycles nutrients.	T F

Figure 1: The ecological role of fire.

Fire influences the physical-chemical environment by

- directly releasing mineral elements such as ash.
- indirectly releasing elements by increasing decomposition rates.
- volatilizing some nutrients (e.g., nitrogen, sulfur).
- reducing plant cover and thereby increasing insolation.
- changing soil temperatures because of increased insolation.

Fire regulates dry-matter production and accumulation by

- recycling the stems, foliage, bark, and wood of plants.
- consuming litter, humus layers, and, occasionally, increments of organic soil.
- creating a large reservoir of dead organic matter by killing but not consuming vegetation.
- usually stimulating increased net primary production, at least on short time scales.

Fire controls plant species and communities by

- triggering the release of seeds.
- altering seedbeds.
- temporarily eliminating or reducing competition for moisture, nutrients, heat, and light.
- stimulating vegetative reproduction of top-killed plants.
- stimulating the flowering and fruiting of many shrubs and herbs.
- selectively eliminating components of a plant community.
- influencing community composition and successional stage through its frequency or intensity.

Fire determines wildlife habitat patterns and populations by:

- usually increasing the amount, availability, and palatability of foods for herbivores.
- regulating yields of nut- and berry-producing plants.
- regulating insect populations, which are important food sources for many birds.
- controlling the scale of the total vegetative mosaic through fire size, intensity, and frequency.
- regulating macroinvertebrate and small-fish populations.

Fire influences insects, parasites, fungi, and so on by

- regulating the total vegetative mosaic and the age structure of individual stands with it.
- sanitizing plants against pathogens such as brownspot on longleaf pine.
- producing charcoal, which can stimulate ectomycorrhizae.

Fire also regulates the number and kinds of soil organisms, affects evapotranspiration patterns and surface water- flow, changes the accessibility through and aesthetic appeal of an area, and releases combustion products into the atmosphere.

Figure 2: Frequency of occurrence.

Species' frequency of occurrence was measured along a 100 ft. transect in a Northwest Florida wetland. A fire occurred in March of Year 1 and May of Year 4, after the annual monitoring data was collected.

Species	Type	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Andropogon glomeratus (broomsedge)	Herbaceous	13	5	8	4	4	2
Calamovilfa curtissii (Curtiss' sandreed)	Herbaceous	52	67	61	66	65	63
Drosera intermedia (spoonleaf sundew)	Herbaceous	28	28	23	35	56	45
Gaylussacia mosieri (woolly huckleberry)	Woody	69	70	78	71	78	76
Ilex coriacea (sweet gallberry)	Woody	23	6	11	4	5	6
Ilex glabra (inkberry)	Woody	86	99	97	93	98	99
Ilex myrtifolia (myrtle-leaved holly)	Woody	2	0	0	0	0	0
Lachnanthes caroliniana (redroot)	Herbaceous	40	100	87	55	99	78
Myrica inodora (odorless bayberry)	Woody	24	11	14	14	3	2
Pinus elliottii (slash pine)	Woody	2	0	0	0	0	0
Rhexia alifanus (meadow beauty)	Herbaceous	0	11	0	0	0	10
Smilax laurifolia (bamboo vine)	Vine	3	8	0	5	2	2

Figure 3: Number of flowe stalks: *Curtiss' sandreed.*

Measurements of the number of flower stalks of Calamovilfa curtissii (Curtiss' sandreed) in ten 3.28 ft.^{2} plots were systematically placed along each of two 100 ft. transects in a North Florida wetland. One transect was within the area of prescribed fire and the second was in a control area, where no fire was implemented.

These additional data on flowering response were collected to supplement the frequency and cover data collected for all species represented in Figure 3 (p. 47). Even though fire's impact on this species was not clear in the frequency of occurrence data, there was a dramatic effect on the flowering response.

Plot number	Within the area that burned the prior year	Within the area that did not burn the prior year (control)
1	129	0
2	1	0
3	32	0
4	0	0
5	21	0
6	0	0
7	15	0
8	0	0
9	160	0
10	72	0

Fire and Ecological Disturbance

EXPLAIN

1. What trends did you observe in the frequency of occurrence data provided in Figure 2?

2. Which species exhibits a strong response to fire, based on frequency of occurrence data?

3. What is the impact of fire on the flowering response of Curtiss' sandreed?

4. Which species increased in frequency after the fires?

5. Which species decreased in frequency after the fires?

6. Which species seemed to be little affected by the fires?

ELABORATE

1. Why would you think a beech or magnolia hardwood forest on a very dry, upland ridge would burn less frequently than a dense coastal grass marsh?

2. Do you think a catastrophic wetland fire can be beneficial?
If so, how?

3. Identify one plant species and one animal species that are considered fire-dependent, and explain their responses to and requirement for periodic fire.

4. Why did we see different species responding differently to fire?

Fire and Ecological Disturbance

ELABORATE

1. Why would you think a beech or magnolia hardwood forest on a very dry, upland ridge would burn less frequently than a dense coastal grass marsh? (An appropriate response focuses on the types of fuels available in each community and an understanding that grasses and pine needles [fine fuels] readily carry fire, whereas hardwood leaves do not.)

2. Do you think a catastrophic wetland fire can be beneficial?
If so, how? (An appropriate response includes the conditions needed for a catastrophic wetland fire [i.e., drought] and how such fires can consume organic material and lower the elevation of the substrate, allowing different species to recolonize [i.e., reset succession].)

3. Identify one plant species and one animal species that are considered fire-dependent, and explain their responses to and requirement for periodic fire. (There are several appropriate responses to this question, but students should base their answers on available data.)

4. Why did we see different species responding differently to fire? (There are many acceptable responses for this item, including the plants' health, the amount of soil moisture present, fire intensity, weather conditions during the burn, standing water in some locations, and reduced fuel in some spots.)