Question 3

Invasive species, such as red fire ants, introduced into an ecosystem often threaten native plants and animals.

(a) **Describe** THREE different factors that contribute to the success of invasive species in an ecosystem.
(3 points maximum)

Factors that contribute to the success of invasive species (1 point each)
- No natural predators, parasites, pathogens.
- Effective aggressive mechanism of invasive organism.
- No limitation on resources.
- No environmental inhibitors (e.g., pollutants).
- R-selected species; increased season for reproduction; large or logarithmic populations.
- Variation in phenotype of large population.
- Available niche not occupied by any other species, hence no successful competitors.
- Prey lack effective defense mechanism against introduced species.
- Appropriate environmental conditions (e.g., rainfall, temperature).

(b) **Discuss** THREE ways that an invasive species can affect its new ecosystem.
(*3 points maximum*)

Ways that an invasive species can affect its new ecosystem (1 point each)
- Eliminates or decreases competitive species, thus decreasing biodiversity.
- Gause's Law of Competitive Exclusion.
- Decreases resources available for other species (food, shelter, reproductive space).
- Changes habitat (adds toxins; overpopulation).
- Addition of invasive species to unoccupied niche, thus increasing biodiversity.
- Introduction of parasitic microorganism living in the invasive species into native population.
- Resource partitioning.

Question 3 (continued)

(c) The map indicates the spread of the red fire ant after its initial entrance into the United States at the port of Mobile, Alabama, in the 1930s. **Discuss** TWO environmental factors that might have determined the pattern of fire ant invasion.
(2 points maximum)

FIRST REPORTED OCCURRENCE OF RED
IMPORTED FIRE ANT, *SOLENOPSIS INVICTA*

■ 1931
■ 1953
□ 1974
□ 2000
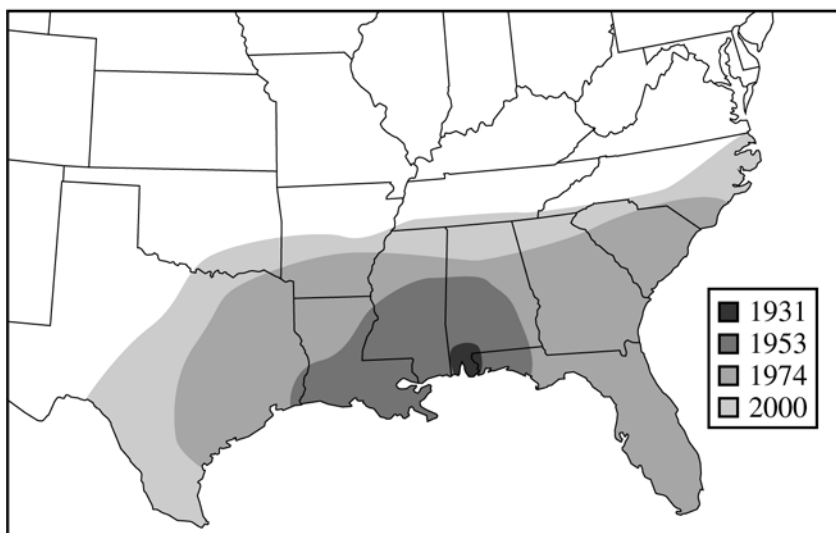
Environmental factors that might have determined the pattern of fire ant invasion (1 point each)

- Temperature: Warm temperatures (lack of freezing), as found in southeastern United States.
- Rainfall/humidity: Adequate moisture, as found in southeastern United States.
- Appropriate soil composition for nest building.
- Available space and unlimited resources.
- Habitat limitation: Salt water on southern and eastern coasts.

(d) **Discuss** TWO possible methods of eradicating or slowing the spread of these ants, including the environmental consequences of each method.
(2 points maximum)

Response must include both methods and consequences.

Methods (1 point)	AND Consequences (1 point)
Introduce sterile males or females	May lead to increase in population size of other species; opening of new niche.
Pesticide	Toxic to other organisms or the environment; pesticide-resistant strain increases.
Introduce predator	Long-term effects (positive or negative) on other species when fire ant population decreases.
Introduce infectious agent	Effects of infectious agent on other species.
Eliminate food source or preferred habitat	Effects on other species.

3. Invasive species, such as red fire ants, introduced into an ecosystem often threaten native plants and animals.

(a) **Describe** THREE different factors that contribute to the success of invasive species in an ecosystem.
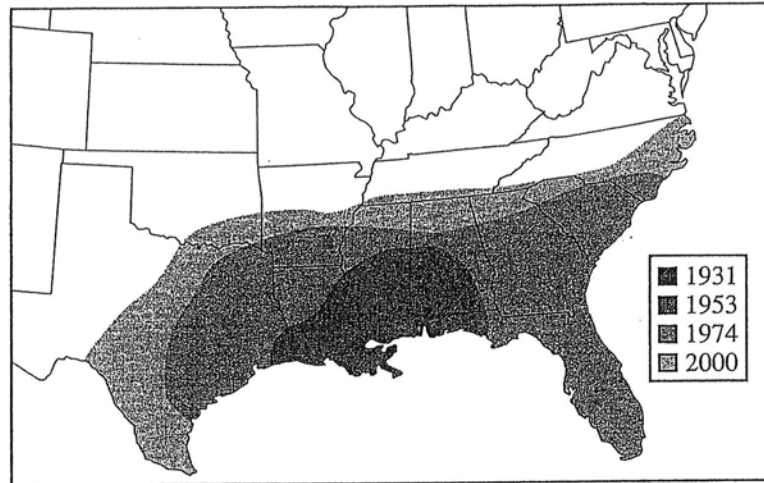
(b) **Discuss** THREE ways that an invasive species can affect its new ecosystem.

(c) The map indicates the spread of the red fire ant after its initial entrance into the United States at the port of Mobile, Alabama, in the 1930s. **Discuss** TWO environmental factors that might have determined the pattern of fire ant invasion.

(d) **Discuss** TWO possible methods of eradicating or slowing the spread of these ants, including the environmental consequences of each method.

FIRST REPORTED OCCURRENCE OF RED IMPORTED FIRE ANT, *SOLENOPSIS INVICTA*

- 1931
- 1953
- 1974
- 2000

3(a) One factor attributed to the success of an invasive species is a lack of naturally established predation. Without a natural predator, this species can increase in number rapidly compared to ~~its~~ native peer species.

Another factor is ~~that~~ the balance ~~of~~ or distribution of nutrients in the new ecosystem. If a species requires nutrients in a new combination or distribution and it is present in the new ecosystem, it will be the only species in its niche and

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therefore, will not have to compete with other species to obtain nutrients/resources.
A third factor is ~~fast~~ a high biotic potential +fecundity relative to native species. The ability to reproduce faster than ~~most~~ native species allows it to grow in size faster and, thus, use more resour

(b) One way is that it will ~~deplete~~ deplete its ecosystem of the nutrients it consumes. As an introduced species, there may be no native mechanisms in place for replenishing its consumed nutrients.

Another way is that it will decrease the diversity of the ecosystem. As it consumes ~~replenishable~~ nutrients faster than they can be replaced, other native species reliant on the same nutrients/resources will be killed off, thus reducing ~~ecological~~ species diversity.
~~A third~~

A third way is that it can create new simbiotic relationships (helpful or hurtful) with other native species. For example, it may serve to aerate the soil through tunnelling, thus helping plants obtain nitrogen from the atmosphere. Over time, a new species of plant may develope that grows through old ant tunn

(c) One environmental factor is high temperatures typical of the red fire ant's native habitat. With ~~any~~ temperatures analogous to its home, it would not be limited in any way in terms of life cycle (no winters) and tolerance (no warming

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mechanisms). The evidence for this reason is that the spread is confined to southern states.

Another ˇfactor is the ant's proximity to water. As evident from the graph, the ants do not inhabit Western Texas. Western Texas is not close to the Gulf of Mexico. A proximity to the ocean may be important in the ant's need of a certain frequency of rain, weather and temperature fluctuations.

(d) One possible method is developing and spraying a pesticide that kills the ants directly. This would decrease their population growth, thus slowing their spread. ~~The~~ Environmental consequences include killing off similarly-affected species (closely-related species such as carpenter ants) and thus, further reducing the species diversity of the ecosystem. Also, water would be polluted from runoff, affecting drinking water and aquatic environments
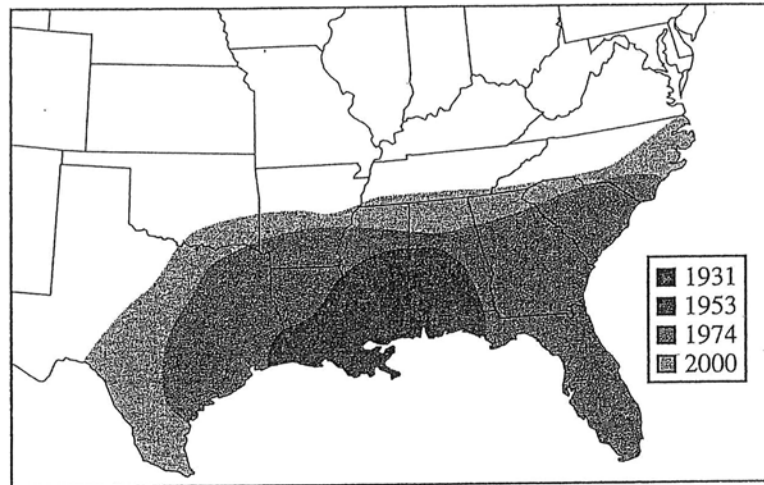
Another possible method is introducing a natural predator from the ant's native habitat. This would ① be a more natural method, however, careful analysis must be given to the new species's requirements and its own predators. If this is not accounted for it too will become an invasive species especially because of ~~the~~ it's food's (red fire ant's) population explosion!

3. Invasive species, such as red fire ants, introduced into an ecosystem often threaten native plants and animals.

   (a) **Describe** THREE different factors that contribute to the success of invasive species in an ecosystem. **3B**₁

   (b) **Discuss** THREE ways that an invasive species can affect its new ecosystem.

   (c) The map indicates the spread of the red fire ant after its initial entrance into the United States at the port of Mobile, Alabama, in the 1930s. **Discuss** TWO environmental factors that might have determined the pattern of fire ant invasion.

   (d) **Discuss** TWO possible methods of eradicating or slowing the spread of these ants, including the environmental consequences of each method.

FIRST REPORTED OCCURRENCE OF RED
IMPORTED FIRE ANT, *SOLENOPSIS INVICTA*

■ 1931
■ 1953
■ 1974
■ 2000

Invasive species prove to be very successful in new environments. One reason is that they can quickly adapt to their surroundings and can prove to be able to survive. Another is their ability to dominate the native species and take over their ecological niches. A third is that the new species are disposed to adapt to ensure their survival while the native species take a longer time to react to the introduction of the new species.

One way an invasive species can affect its new ecosystem is by competing with another species for a food source. This will cause the other species to slowly die

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3B₂

out as their source of nutrients is consumed by the invaders. A second way is by providing another food source for a consumer species. This can have two effects: it can benefit that animal that consumed it and it can cause an excess of a plant that is no longer being consumed. A third way is that an animal species can feed on a population and that population would go extinct, causing a chain reaction in other areas of the community.

The fire ant invasion showed great success. One environmental factor is that the port that the ants arrived at directly suited the needs of the fire ants. They immediately found a viable food source and so could easily reproduce and allow their population to spread. A second environmental factor that aided the fire ants is their ability to dominate an area and adapt to surroundings to fit their needs.

After more than seventy years of the fire ant being a part of the ecosystem, they have made their presence an important one. One way to slow the spread would be to wipe out their food source. This, however, would cause a problem in that the animals that feed on the ants would decrease as well. Also, wiping out an entire food source that spans many states is a difficult task and could potentially harm the environment. Another method would be to introduce another species that would wipe out the red ants. However this poses a problem because once the red ants were gone, the species would need something
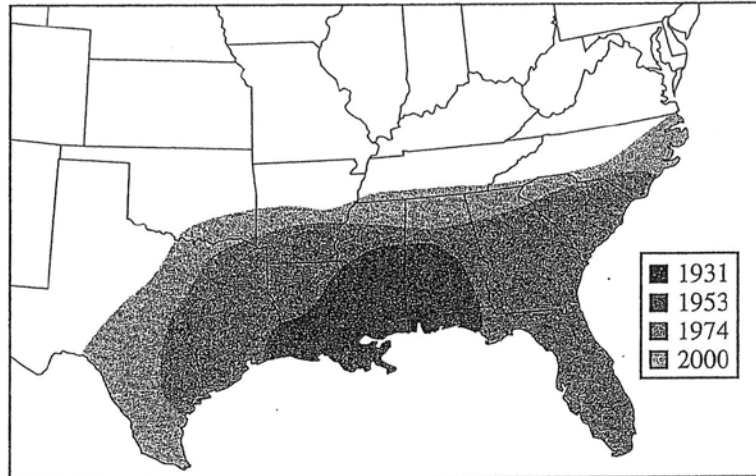
else to feed on and might feed on animals that are needed. 3B₃

3. Invasive species, such as red fire ants, introduced into an ecosystem often threaten native plants and animals. **3C₁**

   (a) **Describe** THREE different factors that contribute to the success of invasive species in an ecosystem.

   (b) **Discuss** THREE ways that an invasive species can affect its new ecosystem.

   (c) The map indicates the spread of the red fire ant after its initial entrance into the United States at the port of Mobile, Alabama, in the 1930s. **Discuss** TWO environmental factors that might have determined the pattern of fire ant invasion.

   (d) **Discuss** TWO possible methods of eradicating or slowing the spread of these ants, including the environmental consequences of each method.

FIRST REPORTED OCCURRENCE OF RED
IMPORTED FIRE ANT, *SOLENOPSIS INVICTA*

▨	1931
▨	1953
▨	1974
▨	2000

a) Three different factors that allow ~~plants~~ invasive species to thrive in an ecosystem include predators, ~~population~~ Reproduction, and the amount of food available. When an invasive species comes in an ecosystem a great factor that contributes a great success to ~~these~~ species is its predator. If there had been a predator for these ants their population would have been limited during the 1930's, but because the fire ants natural predator doesn't live in America ~~it~~ the species was able to eat and devour anything in its path. ~~Population~~ Reproduction is also a great factor. Because the fire ants are a fast reproducting species, they were able to recreate a strong thriving population that couldn't be contained. The last factor is the amount of food available. The fire ants,

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3C₂

first of all, can practically live on anything as ~~the~~ it eats ~~eats~~ many types of food. Now the amount of food in North America was very plentaful for these ants therefore they were able to survive. ~~the~~

b) The three ways that invasive ~~evasive~~ species can affect an ecosystem is by ~~eating~~ consumption, destruction, and land. Invasive species easily destroy ecosystems with the great amount of consumption they can have since their natural predator is nowhere around to consume ~~this still are species;~~ therefore, the food that was part of the ecosystem is gone and ~~therefore the~~ ecosystem colapses. Destruction of other animals is also an affect on an ecosystem. If the invasive ~~species~~ destroys land, food, or the primary consumer the ecosystem can't live now since all of its support is now gone and the higher level consumers can't eat. The third way that an invasive species destroys an ecosystem ic by taking land such as the rabbits in Australia did ~~during in the~~ which caused not ~~enough~~ land to support Australias ecosystem.

c) Two environmental factors is that there were no predators for the ants and that ~~food was~~ / still is very abundant; therefore, the ants were able to roam freely, without fear of death, and eat whatever they wanted therefore they spread out dispersing themselves among other ecosystems.

d) Two methods are using pesticides to kill all the fire ants or bringing its natrual predator over to America to eat all the fire ants and then take the predator back to its ecosystem.

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Question 3

Sample: 3A
Score: 10

The response earned the maximum of 3 points in part (a). One point was earned for stating, "Without a natural predator, this species can increase in number rapidly"; 1 point was earned for explaining that the species could utilize new combinations of available resources; and 1 more point was earned for describing the advantage of a rapid-reproduction life strategy in the new environment.

The response earned the maximum of 3 points in part (b). One point was earned for discussing how an invasive species can "deplete its ecosystem of the nutrients it consumes." The response earned a second point for discussing the elimination of "native species reliant on the same nutrients/resources." A third point was earned for discussing the potential change to habitat, using the example of soil aeration that results from tunneling.

The response earned the maximum of 2 points in part (c). One point was earned for the discussion of the effects of hot temperatures, and 1 point was earned for discussing the availability of rain, which is reflected in the data shown on the map.

The response earned the maximum of 2 points in part (d). One point was earned for discussing the use of pesticides, and 1 point was earned for discussing natural predators as methods of eradication.

Sample: 3B
Score: 6

No points were earned in part (a) because it does not provide specific factors.

The response earned the maximum of 3 points in part (b). One point was earned for discussing competition for food resources; 1 point was earned for discussing extinction of a population; and 1 point was earned for discussing a benefit posed by the invasive species.

In part (c) the response earned 1 point for discussing how the availability of a food resource helped the ants spread through the southeastern United States.

In part (d) 1 point was earned for suggesting the removal of the food source of the invasive species, and 1 point was earned for considering the importation of a species that would eliminate the invasive species.

Sample: 3C
Score: 5

The response earned the maximum of 3 points in part (a). One point was earned for discussing the advantage of having no natural predators ("because the fire ants [*sic*] natural predator doesn't live in America the species was able to eat and devour anything in its path"). One point was earned for describing the advantages of being "a fast reproducting [*sic*] species," and 1 point was earned for stating that "the amount of food in North America was very plentaful [*sic*] for these ants."

In part (b) 1 point was earned for explaining that food would be depleted by an invasion of fire ants.

Question 3 (continued)

In part (c) the response earned 1 point for indicating that unlimited amounts of food would encourage the spread of the fire ants, as shown in the map.

No points were earned in part (d). Even though the response identifies the use of pesticides as a way to help eradicate the fire ants, it does not discuss consequences of this method.