

# Ecosystem Network

## Engage:

You have seen and worked with this network so let's make some observations about the network to refresh our memories. In your notebook, make a space for "Observations" and make some observations from the following prompts:

Make some observations about the number, size, etc. of different groups within the network.

Make some observations about individual nodes within the network, possibly number, importance etc.

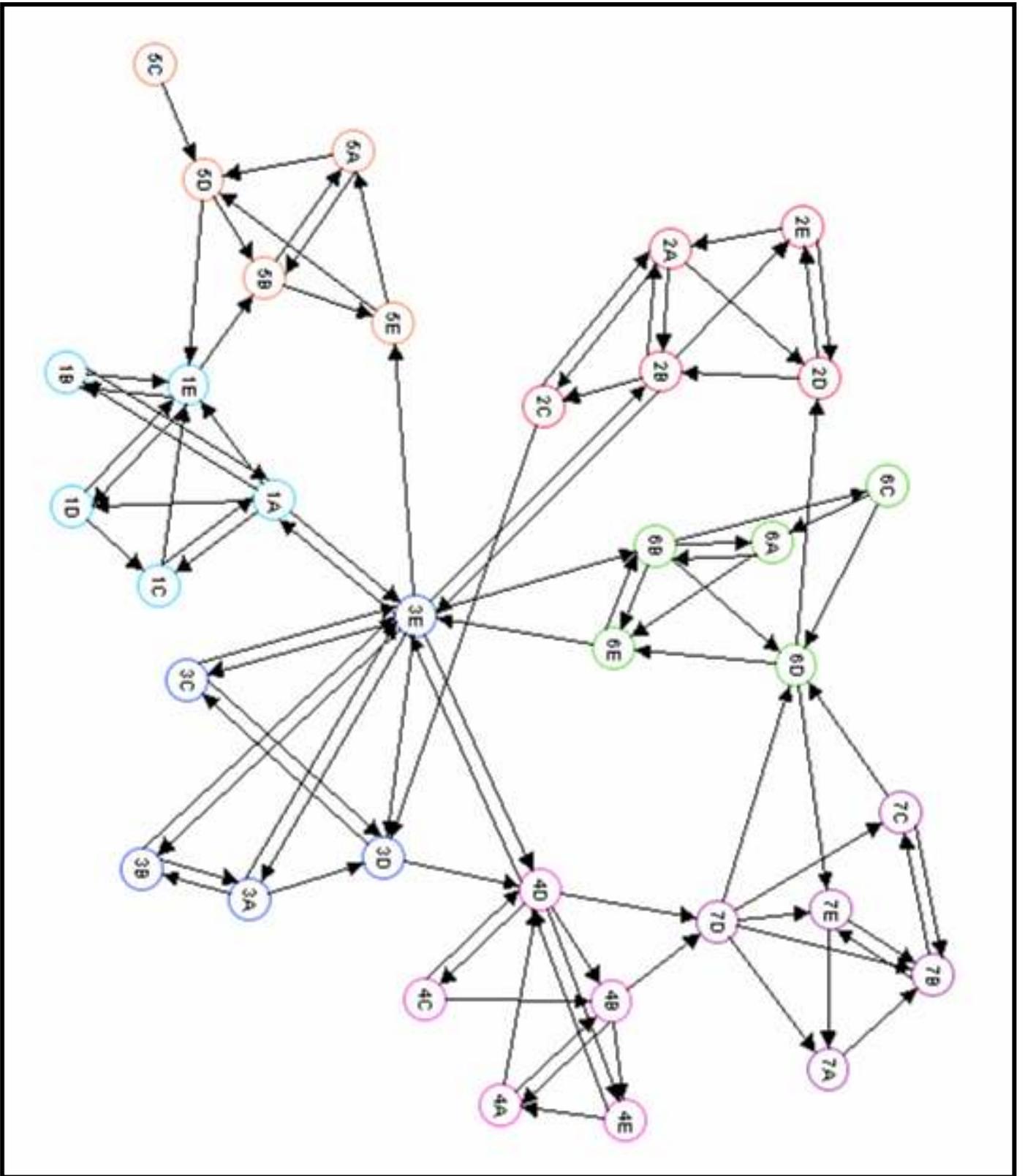
An arch is defined by dictionary.com as "a curved masonry construction for spanning an opening, consisting of a number of wedge like stones, bricks, or the like, set with the narrower side toward the opening in such a way that forces on the arch are transmitted as vertical or oblique stresses on either side of the opening." This is a picture of an arch and there is an important structure of an arch called a keystone. In your notebook, draw an arch, label the brick you think is the keystone, and then justify your reasoning as to which brick you labeled as the keystone.



## Explore:

Directions: Answer the following questions on your own page (journal) using the network map below or going to (<http://baliga.systemsbiology.net/cytoscape/cellphone/help.php>) and selecting "lab simulation" to run the Cytoscape cell phone software. We are going to imagine the cell phone network as an ecosystem. An ecosystem is a collection of all the organisms that live in a particular place, together with their nonliving environment. In order to accomplish this there are some parameters that must be adhered to, so the edges (arrows) in the network represent flow of energy through an ecosystem (6D gives energy to 6E, but 6E does not give energy to 6D), consumers rely on the energy of other organisms for their survival, and groups of organisms have the same number:

1. What individuals (nodes) need to be removed so that 5A has no chance of survival?
2. If 3E were removed from the ecosystem, would 5A have a chance of survival? Justify your response.
3. What is the relationship between 5A and 5B?
4. Would you consider 3D a generalist or specialist when compared to 5A? Justify your response.
5. Would you consider 3D a generalist or specialist when compared to 3E? Justify your response.
6. What individuals need to be removed so that the 3's group has no chance of survival?
7. Rank the groups in order of stability. An unstable network is one that can be cut off from the ecosystem by only removing a few individuals from other groups (numbers), and some groups could share the same rankings
8. If this network were an ecosystem, evaluate the stability of the ecosystem based on the knowledge you have gained.
9. If this network were an ecosystem, what node would correspond to the keystone species? Justify your response.



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Observations:

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The brick I labeled the keystone is the keystone because...

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1. Would you consider this network a food chain? Justify your response.
2. Would you consider this network a food web? Justify your response.
3. If transfer of energy is incomplete and only about 10% of energy is transferred from one living thing to another, what is the largest percentage of energy that 1E could expect from 5A? Thinker question! What is the largest percentage of energy that 7B could expect from 5A?
4. Explain how this network is representative of most of the different levels of ecology, make sure to include which levels of ecology are represented and how they are specifically represented.
5. If this network was the Yellowstone ecosystem, what living organism would 3E represent? Justify your response.
6. If this network was the Yellowstone ecosystem, what living organism would 5C represent? Justify your response.
7. If this network was the Yellowstone ecosystem, what living organism would 5A and 5B represent?
8. In what ways does this cell phone network fail to represent an ecosystem?
9. Why does the network below or attached fit the cell phone scenario but not necessarily exactly an ecosystem?
10. Why do conceptual models (such as the cell phone network) always fail at some point?
11. Why are conceptual models also extremely helpful?
12. What are the advantages of technology in building and analyzing biological conceptual models?

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# Ecosystem Network

## Teacher notes:

This activity was written two different ways to accommodate the teacher that likes their student to keep a notebook or the teacher who likes handouts for their students.

## Engage:

The student should be able to follow the directions to make some observations to acquaint themselves with the network that they used previously. The keystone in the arch is the stone at the very top of the arch that makes the arch able to hold itself up or a great deal of weight above the arch.

## Explore:

1. What individuals (nodes) need to be removed so that 5A has no chance of survival? 5D & 5E give 5A no chance of survival, other nodes are arguable such as 1E or 3E but 5A still has energy coming in but from a much smaller system.
2. If 3E were removed from the ecosystem, would 5A have a chance of survival? Justify your response 5A would have a chance but its chances are diminished because of a loss of energy from the larger system, this is a good chance for a discussion about interrelatedness.
3. What is the relationship between 5A and 5B? They eat each other, remember some species can be eaten when younger but eat others as adult.
4. Would you consider 3D a generalist or specialist when compared to 5A? Justify your response. Generalist, has more alternate methods to get energy (more arrows coming into 3D than 5A).
5. Would you consider 3D a generalist or specialist when compared to 3E? Justify your response Specialist, it has less methods of getting energy (less arrows coming into 3D than 3E). This could be a good discussion point on how everything is relative.
6. What individuals need to be removed so that the 3's group has no chance of survival? 1A, 2B, 2C, 4D, 6E
7. Rank the groups in order of stability. An unstable network is one that can be cut off from the ecosystem by only removing a few individuals from other groups (numbers), and some groups could share the same rankings -- 3's most stable, then 6's and 7's, then 1's, 2's, 4's and 5's.
8. If this network were an ecosystem, evaluate the stability of the ecosystem based on the knowledge you have gained. This is highly debatable, this should lead to good discussion.
9. If this network were an ecosystem, what node would correspond to the keystone species? Justify your response.  
3E, because it is really the lynch pin of the network possibly other such as 1E

## Explain:

This is where the student learns some key ecological such as generalist, specialist, levels of ecology, keystone species, etc. This can be accomplished in many ways and the teacher will need to decide how and what key ecological concepts get relayed to the student.

## Elaborate and or Evaluate:

The following questions could be used for an elaborate or an evaluate, but they should reinforce what they have learned through the engage, explore, and explain.

1. Would you consider this network a food chain? Justify your response-- probably not, because of how interrelated everything is in the network, possible parts of the network could be considered food chains.
2. Would you consider this network a food web? Justify your response -- most definitely, because of how interrelated energy transfer is within the network.
3. If transfer of energy is incomplete and only about 10% of energy is transferred from one living thing to another, what is the largest percentage of energy that 1E could expect from 5A? Thinker question! What is the largest percentage of energy that 7B could expect from 5A? -- 1E could expect 1% from 5A, and 7B could expect 0.000001% from 5A.
4. Explain how this network is representative of most of the different levels of ecology; make sure to include which levels of ecology are represented and how they are specifically represented --The network represents ecosystem (the whole network), communities (groups or numbers within the network), and populations (nodes within the network).
5. If this network was the Yellowstone ecosystem, what living organism would 3E represent? Justify your response -- This is highly debatable; 3E needs to be something that is eaten but yet still eating others, possibilities include: different insect such as dragonfly or stonefly, different small mammals such as voles, shrews, and mice, different fish. Remember some species can be eaten when younger but eat others as adults.
6. If this network was the Yellowstone ecosystem, what living organism would 5C represent? Justify your response -- This is highly debatable, most student responses should work as long as they are justified.
7. If this network was the Yellowstone ecosystem, what living organism would 5A and 5B represent? -- This is highly debatable, most student responses should work as long as they are justified and represent organisms that transfer energy back and forth at some point in their lives (Cutthroat trout and rainbow trout) (many species of insect that eat each other at some point in their lives).