

## ECOLOGICAL SUCCESSION: WORKSHEET

1. Based on the characteristics listed below, predict in what order each species of plant might appear and become established in a successional community. Be sure to explain your reasoning – which characteristics did you consider in formulating your prediction, and why?

| Plant             | Characteristics  | Predicted timing<br>(Early, mid, late)       | Reason  |
|-------------------|--|--|---|
| Alder             | Small deciduous tree. Bacteria in its roots fix nitrogen. Requires lots of sun. Wind dispersal, lots of seeds.   | Mid/early                                    | Small tree with good dispersal. Tolerates harsh conditions (lots of sun). Nitrogen fixation allows it to thrive.              |
| Big leaf maple    | Large deciduous tree. Large seeds are wind dispersed. Grows slowly and is long lived. Requires rich organic soil. Somewhat shade tolerant.                   | Late   | Long-lived and slow growing – it is a good competitor for space and light. Does not arrive quickly.                           |
| Douglas fir       | Large conifer. Low dispersal. Grows well in sun. Not shade tolerant. Reaches maturity at ~15 years.  | Mid  | Doesn't arrive early because low dispersal. Fast growing for a conifer, grows well in sun. Gets shaded out by later arrivals. |
| <i>Dryas</i>      | Small herbaceous plant. Short lived. Grows in high-light conditions in mineral soils. Bacteria in roots fix nitrogen. Light, fluffy seeds dispersed by wind. | Early  | Good dispersal. Tolerates harsh conditions (lots of sun). Nitrogen fixation allows it to thrive. Fast growing.                |
| Lichen            | Fungus/algal combo. Photosynthetic. Obtains nutrients by breaking down rocks. Wind dispersed.  | Early; 1 <sup>st</sup> in primary succession | Disperses well. Tolerates harsh conditions. Does not need soil (creates soil for other organisms).                            |
| Spotted knapweed  | Small herbaceous plant. Grows quickly and produces lots of small seeds. Tolerant of high light, low moisture, and nutrient poor soils.                       | Early  | Weedy species – fast growing with lots of easily dispersed seeds. Tolerates harsh abiotic conditions.                         |
| Western red cedar | Large conifer. Long-lived and slow growing. Shade tolerant. Short distance dispersal   | Late   | Long-lived and slow growing – it is a good competitor for space and light. Does not arrive quickly.                           |

General characteristics of early pioneer species:

Weedy – fast growing with fast reproduction. Tolerant of harsh conditions such as lots of sun, dryness and low nutrients.

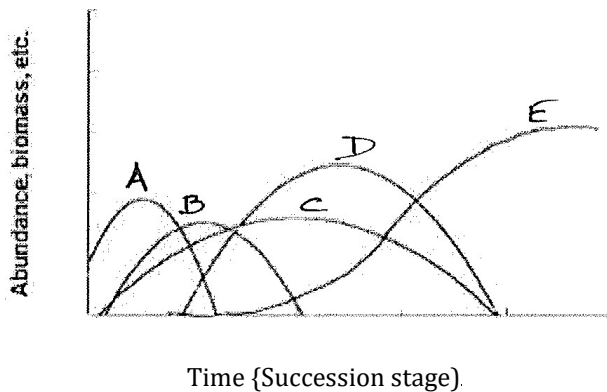
General characteristics of late successional species:

Good competitors – able to out compete the early and mid plants that are already there. Slow growth, slow reproduction, long-lived plants require more favourable conditions – high nutrients, moisture, organic soils.

Nitrogen fixers like Alder and Dryas are important in the coastal BC region because they increase the available nitrogen in the soil that other plants can then use (but note that they are not absolutely required, if other sources of nitrogen are available).

- Will abiotic or biotic factors be more important in determining the composition of *early*-successional communities or *late*-successional communities? Support your answer by providing specific examples of factors that would determine the biological niches of species in each of these situations.

In the early stages of succession, there will be relatively few species around, which means there will be relatively few biotic interactions. On the other hand, the environmental conditions are often harsh, with little shelters to protect organisms from the elements, – whether or not a species can survive in that environment often depend more upon its ability to tolerate and copy with the abiotic conditions. By contrast, during late succession the environmental conditions are relatively favourable and many species can survive (according to their fundamental niche). Because there are more species, there will also be more intense interspecific competition for space, nutrients and light (competition is a biotic factor). Whether or not a species can survive in a late-successional community will depend heavily on its ability to interact with other species (e.g., competition).



- Provide one plausible explanation for the decrease in abundance of plant B.

Species A and B are pioneer species that can thrive in environments that are harsh where few other species can survive. They often face little competition (interaction) with other species. As the species grow, they gradually alter the environment, providing more shade and increasing soil depth that retains moisture better. This environment becomes more stable that allows other species to move in. Over time, the altered environment becomes less suitable for pioneer species A and B due to increased presence/competition of other species such as C. Species A and B gradually get crowded out and disappear from the environment.

2. List two possible life history traits for plant E.

Plant E is likely a slow growing species that can compete well with others for limited resources because it usually arrives at an environment already full of other species all requiring limited resources (sunlight, nutrient, water, space). It also likely produces relatively few but large seeds, with each seed packed with reserve to survive in a highly competitive environment for a long period of time (a K selected strategies).

3. Can plant E tolerate low light intensities? Explain your answer.

Plant E most likely can tolerate low light intensity because when it arrived, the site had already been occupied by other plant species such as D and C, which most likely have created a shady environment. The seeds of plant E must be able to tolerate shade to grow in such environment.