**Response (Dependent) Variable** - lichen presence or abundance, air quality index

**Predictor (Independent) Variable** - tree diameter, tree species, % canopy cover, aspect, bark pH.

1. **Pollution Source**

We expect a positive correlation between air quality and fruticose lichen in respect to the proximity to the papermill and downtown Sylva. We expect the air quality to be poorer the closer we get to the papermill/downtown Sylva. Since lichen, primarily fruticose, are incredibly sensitive to air quality, we should see denser populations of them the further we get from downtown. As the air quality increases, the density of fruticose lichen will also increase.

1. **Bark pH**

Tree bark has may have different pH values. Lichen will be more abundant on trees with higher (more basic) pH values.

1. **Light**
	1. Amount

Lichen needs sunlight to be able to perform photosynthesis so therefore areas that come in contact with a lot of sunlight should have a high amount of lichen. If there is a high amount of sunlight (southern aspect) in areas that also have the other resources lichen needs to produce then we predict there to be a higher abundance of lichen over areas that lack in sunlight (northern aspect).

The direct sunlight on the southern side of the tree will reduce the moisture available to the lichen. It will then leave the Northern side of the tree a more adequate place for lichen to live.

* 1. **Canopy Cover**

Trees all have different types of canopy’s so that means the amount of sunlight that seeps through the trees canopy will be different amounts. I think that depending on the tree type and how much sun will be able to reach the lichen will have an affect on the lichen.

1. **Substrate**
	1. **Surface**

Natural substrates tend to already have everything a lichen could need to live while on a manmade structure it may have a hard time gathering all of the nutrients necessary. Lichen would prefer to colonize on natural substrates rather colonize on manmade substrates.

It would be easier for Lichen species to cling to smoother bark, in that, there would be less obstacles impeding Lichen growth. trees with a smoother bark type would have more lichen diversity than trees with rougher bark types due to the fact that it would be easier for the lichen to cling to.

Crustose lichen can form easily on even sheer rock faces, whereas fruticose and foliose lichen seem to prefer a higher quality substrate, so perhaps the thicker bark is a higher quality substrate and would be more likely to support the less tolerant lichen types. A greater bark thickness will allow for a greater amount of fruticose and foliose lichen whereas very thin bark will be more likely to support crustose lichen.

* 1. **Tree Species**

Different lichen types may require certain nutrients that only some tree species offer, Differing types of lichen will occur on tree species that offer the habitat/nutrients the lichen prefer

1. **Amount of water available**

Lichen need water/moisture. If there is lots of rainfall in the area/environment that the lichen is located, then there is a higher possibility that it will continue to photosynthesize longer and have a diversity. When pairing these four factors together I suspect there to be a negative relationship between lichen and the windward/ leeward sides of mountain ranges

**6. Roads/Cities/Humans**

 More metal deposition on substrate (pollution from roads/human caused disturbance (severe fire) leads to a less plentiful or diverse lichen population, while less metal deposition leads to a more plentiful and diverse lichen population. Therefore, lichen populations within and around cities (or roads) will be less plentiful and diverse, while populations in and around rural areas will be more plentiful and diverse. Because vehicles are known to emit air pollutants, and are largely confined to roadways, it can be predicted that less variation and fewer amounts of lichen will be observed in areas that are within close proximity to moderate-to-high traffic roadways compared to areas of similar habitat that are not near such roadways.

**Where to sample/What to compare?? = Along gradient of independent variable**

-Low light (dense canopy/north aspect) vs. High light (open canopy/south aspect)

-Low pH tree species vs. High pH tree species

-Low Pollution (away from roads/far from papermill/rural) vs. High Pollution (near roads/close to papermill/urban)

-Low water (drier geographic locations/leeward side) vs. Higher water (wetter locations/windward side)

-Smooth surfaces (tree species(beech)/thin bark) vs. Rougher surfaces (tree species(oak)/thicker bark)