

# Template for Working Group Summary for the Appalachian Trail Environmental Monitoring Program

Draft Version: 18 September 2006

---

## Summary Recommendations:

*Please provide a 1-3 paragraph summary of the report.*

## Detailed Information:

### 1. Scope: *What is the scope of the working group?*

The air quality and climate group, as the name implies, is focused on the effects of air pollution and climate change.

**Air quality** is a multi-dimensional component of environmental health that is of vital importance in the high elevation biomes of the Appalachian Region where pollution exposure and deposition rates are typically at their maximum. The highlands intercept concentrated pollutant layers, the effect of which is exacerbated during periods of air stagnation, common in the summer in the southern Appalachians. Air pollution is an environmental and human health concern. Criteria pollutants of the 1970 Clean Air Act and 1977 and 1990 amendments include sulfur dioxide, ozone, nitrogen dioxide, particulate matter, lead and carbon monoxide. Pollutants can be introduced via clouds, rain, snow and dry deposition. Direct adverse effects are acidification or eutrophication of soils and streams, foliar damage from ozone and acid deposition to sensitive plant species (e.g. ozone damage to black cherry; deposition damage to red spruce) and human respiratory injury. Indirect effects include loss of visibility and changes in soil ion concentrations (i.e., an increase in aluminum and a loss of magnesium and calcium ions).

**Climate change** has the potential to dramatically affect the Appalachian Region. The numerous high elevation biomes that the AT traverses include assemblages of plants and animals that are climate sensitive as represented by limited extent of their range. In many locations, species at the southern extent of their range coexist with species at the northern extent of their range. One of the most compelling values of the scale of the Appalachian Trail mega-transect is to study at a large scale the potential climate related influences on species richness and diversity. Another aspect is that the Appalachian Trail has the potential to function as a corridor for species to move in response to a changing climate. Where else in the East is there an uninterrupted portion of land where species have such freedom of movement? *{not as articulate as I'd like; feel free to re-phrase}*

**2. Key Information Needs / Monitoring Questions:** *What are the critical information needs to which data collected through the AT Monitoring Transect might be applied? Who are the primary audiences for each question and how detailed is the information they need?*

**Air Quality** – How are levels of key pollutants changing over time and space? Specifically:

- 1) What are the trends in important ion concentrations and atmospheric deposition? How does deposition impact soil and water chemistry and the associated flora and fauna along the AT? Are there any impact thresholds related to deposition and water chemistry?
- 2) What are the trends in ozone concentrations? How do ozone levels affect human health and vegetation? Are there any thresholds for human health and vegetation impacts?
- 3) What are the current conditions/levels and trends of particulate matter and visual range on the AT?
- 4) Can we document and predict rates of change in air quality conditions and associated air quality related values?

**Climate** – Is the climate changing over time and space? Specifically:

- 5) What are the trends in key climate indicators?
- 6) Can we document and predict effects of climate on key species and ecosystems that are most sensitive to climate effects?

This information will be of use to three primary audiences as outlined below. One interesting facet of the air quality and climate information is that the source of the problem is often located far from the AT. To this end, the information has to reach audiences in far away states and at the federal level.

- **Managers and Decision Makers** – The information can be used to inform the debate on pollution regulation and mitigation. The more credible the information is, the more powerful it will be.
- **General Public** – The information can be used to help educate and inform the public. Information does not need to be extensive, but it has to include compelling stories and be credible.
- **Scientists and Researchers** – They can use this information to inform their work and to guide additional research efforts.

**3. Key Indicators:** *What are the indicators for each question? Provide a brief description of and rationale for each indicator. What data sets currently exist for each indicator? What additional information is needed? What methods could be used to collect this information? Who would collect these data? What would it cost? (note that this information can be in text and/or table format)*

## **Air Quality**

- Key parameters for atmospheric deposition trends are concentration and deposition of nitrate, ammonium, sulfate and key anions. Existing data:
  - NADP for wet deposition (<http://nadp.sws.uiuc.edu/>)
  - CASTNet for dry deposition (<http://www.epa.gov/castnet/>)
  - NADP-MDN for mercury (if we get to that) (<http://nadp.sws.uiuc.edu/mdn/>)
  - Key parameters for trends are ozone concentration metrics of 1-hr and 8-hr concentrations. The AIRNOW website (<http://airnow.gov/>) shows current ozone conditions (for the AT as well as the rest of the country. AirData (<http://www.epa.gov/air/data/>) contains raw datasets that can be manipulated to obtain values for various ozone metrics as well as summaries of pollutant concentrations and trends. CASTNet also has ozone measurement, but data are harder to get to. Data exist that will need to be summarized for the following:
    - Days each month (week, year) that are over the 8-hour standard concentration level
    - Frequency of exceedances of 1-hr and 8-hr standards, as well as moderate (yellow) and 'orange' days (code red is exceedance)
    - Attainment status of ozone areas
    - Also need to look at vegetation impacts of ozone: SUM06, W126, N100.
- (this is implied by listing SUM06 and W126) Key parameters for particulate matter are extinction, PM<sub>2.5</sub>, PM<sub>10</sub>--mass as well as chemical composition.
  - Attainment status for PM
  - IMPROVE monitoring
  - Attainment of annual and daily standards (is this the same as the first bullet?)
  - Number of days in each attainment category (not sure what this means)
  - Other monitoring for PM<sub>2.5</sub>, PM<sub>10</sub>
    - AQS data (<http://www.epa.gov/air/data/>)
    - STN
    - FRMs

- Continuous PM monitoring (TEOMs, BAMS)
- Key parameters for visual range?
  - Associated with EPA's regional haze rule
  - 20% worst and 20% best days
  - annual average
  - use IMPROVE data
  - park and USFS/state web cameras for visibility
  - WINHAZE
  - VIEWS - back trajectories can be projected from this site.
- Tonnie Maniero compiled a summary table of NADP, CASTNet and IMPROVE monitors within 100 km, and continuous ozone monitors within 30 km, of the AT in 2002. Casey Reese, AT GIS specialist, prepared geo-referenced maps showing locations of those monitors in 2004-2005. The table/maps can serve as a starting point for database development.

### **AQ Links**

- Key parameters for water impacts are stream pH and ANC.
- Also soil impacts: soil chemistry: Ca/Al ratio. C/N ratio. Cation exchange capacity. Al:Base cation ratio. Soil solution ANC.

### **Climate**

As a first step, we need historic data important to use as a baseline. Contact UNC-Asheville for their archive of doppler (and other) weather data. Look for similar centers of information along the AT.

- Temperature and humidity by elevation and aspect and slope
- Precipitation: how much and what type--rain, snow, hail, etc.
- Barometric pressure
- Wind speed and evaporation rate
- Frost free days
- Heat index
- Long term trends
- Look for greenhouse gas emission inventories (potentially)

### **Climate Links**

First we need to ask the other working groups what data they will need to make the connections between long-term weather (climate) and impacts and changes. --We're planning an inter-group call. Some links we already see are:

- Comparative records of fire incidents and acres consumed

- Thresholds for sensitive species
- Invasion/movement of pests and pathogens



#### **4. Citizen Science: What is the role for citizen science in this work?**

##### **Ozone:**

- Protocol for detecting ozone injury to vegetation in certain locations.
- Use passive ozone monitors in local areas
- GLOBE monitoring program (for schools, other?)
- Expand use of bio-monitoring gardens

##### **Visibility**

- Photos sent in by hikers, AT folks sort by date and associated PM and humidity levels.
- Georgia Murray has developed a 'postcard' with viewsheds on it, allows hikers to compare, comment and react to the view they experience

#### **5. Challenges and Unresolved Issues: What are some of the key challenges that this group will face? What additional issues need to be considered?**

We have some data already summarized and public-ready. We know where to get a lot more that is currently being collected and only needs to be summarized in a format that will be meaningful to the public.

One of the biggest challenges I see is that air quality and climate are really important because of their impacts to humans and to the resources. We MUST coordinate with the other groups to make our data meaningful. Otherwise it's only so much noise (or in this case, haze)...

#### **6. About the Group: Who was involved in this working group? Who else should be consulted?**

[Alan\\_Ellsworth@nps.gov](mailto:Alan_Ellsworth@nps.gov)  
[cdufour@appalachiantrail.org](mailto:cdufour@appalachiantrail.org)  
[gmurray@outdoors.org](mailto:gmurray@outdoors.org)  
[gtierney@esf.edu](mailto:gtierney@esf.edu)  
[holly\\_salazer@nps.gov](mailto:holly_salazer@nps.gov)  
[jpeine@utk.edu](mailto:jpeine@utk.edu)  
[Jim\\_Renfro@nps.gov](mailto:Jim_Renfro@nps.gov)  
[kkimball@outdoors.org](mailto:kkimball@outdoors.org)  
[mmiller@appalachiantrail.org](mailto:mmiller@appalachiantrail.org)  
[rlitwin@usgs.gov](mailto:rlitwin@usgs.gov)  
[sligi@appalachiantrail.org](mailto:sligi@appalachiantrail.org)  
[Tonnie\\_Maniero@nps.gov](mailto:Tonnie_Maniero@nps.gov)  
[Julie\\_thomas@nps.gov](mailto:Julie_thomas@nps.gov)