

Protocol Development Summary

Protocol:

Monitoring Weather and Climate Change [short name: Weather and Climate]

Parks Where Protocol will be Implemented:

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Justifications/Issues being addressed:

Weather and climate are key drivers of ecosystem structure and function. A long-term pattern in temperature and precipitation provide first-order constraints on potential ecosystem structure and is a potentially important correlative factor for every other vital sign, making it a high priority vital sign for the network. Therefore, the network will develop an effective climate-monitoring system to track climate changes and to aid parks in making management decisions relating to climate. In addition, the network will use weather data for correlative analysis with other vital signs such as water quality, vegetation, and amphibians to track the effects and functions of weather within these systems.

Specific Monitoring Questions and Objectives to be Addressed by the Protocol:

- Collect and maintain an archive of weather and climate data for network parks using existing stations in and around park boundaries.
- Use data to monitor effects of weather and climate change on other network vital signs.

Basic Approach used in the GULN Weather and Climate Protocol:

Climate and weather monitoring will rely primarily on existing active climate monitoring network stations in and nearby GULN parks. If a given area or park unit lacks stations altogether, short-term stations to document correlations to other sites (or lack thereof), or new long-term stations may be added. Data from existing climate monitoring network stations will be analyzed for the GULN parks.

Existing Weather stations: A number of networks/agencies with existing protocols are operating weather stations in the GULN, including: NOAA-COOP, RAWS, HaleNet, and the NPS Gaseous Pollutant Network. Protocols for these networks have been reviewed to ensure that they conform to NPS standards and that data are comparable. This review was performed as part of a Task Agreement (J8R07050017) between WRCC and NPS.

Parameters measured: Not all parameters will be included at all monitoring stations, as station equipment varies depending on which climate monitoring program the station belongs to. COOP stations measure either temperature or precipitation or both. RAWS stations measure more variables, but do not all have the same set of sensors; many

include sensors for soil moisture and soil temperature and fuel moisture. New stations that may be set up by the GULN (and do not belong to any of the existing climate monitoring programs) will measure at the very least air temperature, wind speed and direction, relative humidity, precipitation, total solar radiation, and barometric pressure.

Data management: All weather/climate station data for existing stations in the GULN area, including those in close proximity to GULN parks, will be downloaded from [NPCLime](#) on an annual basis. The database is a modified version of PACN's weather and climate database in MS Access XP format. The database will include station locations, as well as metadata for the stations such as: latitude, longitude, elevation, network operating the station, period of record, parameters measured. In the long run, the database will be a useful tool for researchers and park managers to provide easy access to historical and current weather observations. In the future, this database will be available online through the GULN website or VSIMS.

Analysis and Reporting: Data will be presented in tables and figures. Tables will consist of an example for the monthly climate summary and annual climate summary for selected park stations. Core climate variables (e.g., maximum temperature, precipitation, wind) will be presented. Averages, percentiles, and the number of days when daily rainfall exceeds a certain threshold (e.g., 2 inches) will be given. Time series of climatic variables along with their long-term trends determined by linear regression models will be plotted. This will show how climate has changed and how this change may have affected parks. Data will be presented in annual reports as well as five-year trend reports.

Principal investigators and NPS lead:

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