ABSTRACT: Drought-related, continental-scale forest mortality events have been observed with increasing frequency during the past 20 years. These events have affected tropical rainforests, temperate mountainous and Mediterranean forests, and boreal forests. In the future, droughts are predicted to be accompanied with increasing temperatures that could promote forest mortality via its impact on evaporative demand and plant respiration rates. Thus, regardless of future predicted precipitation, periods of low rainfall may cause greater mortality due to higher temperature.

To tease apart the effects of drought and heat on plant physiology and survival we have built an ecosystem scale manipulation experiment to simulate possible climate change effects in pinon-juniper woodland in Los Alamos NM. Five trees from both species under drought, heat, combined drought and heat, and control treatments are monitored closely until mortality. The measurements are targeted to reveal how the trees die based on the current leading hypotheses of plant mortality mechanisms: hydraulic failure and carbon starvation. The monitored variables range from soil moisture content profiles and meteorological data to plant gas exchange, bole and leaf temperatures, and non-structural carbohydrate content of different tissues. Drought treatment uses plastic ducts 1.2 m above ground, that direct 50% of precipitation away from the site. Heat treatment is produced with air conditioning units controlling the climate in open top chambers. The temperature in the chambers is kept at 5°C above ambient all the time. In this presentation we show results from the first year of the experiment. No trees have died yet, but the treatments work as expected, and after a very dry winter, tree mortality is anticipated this coming summer.