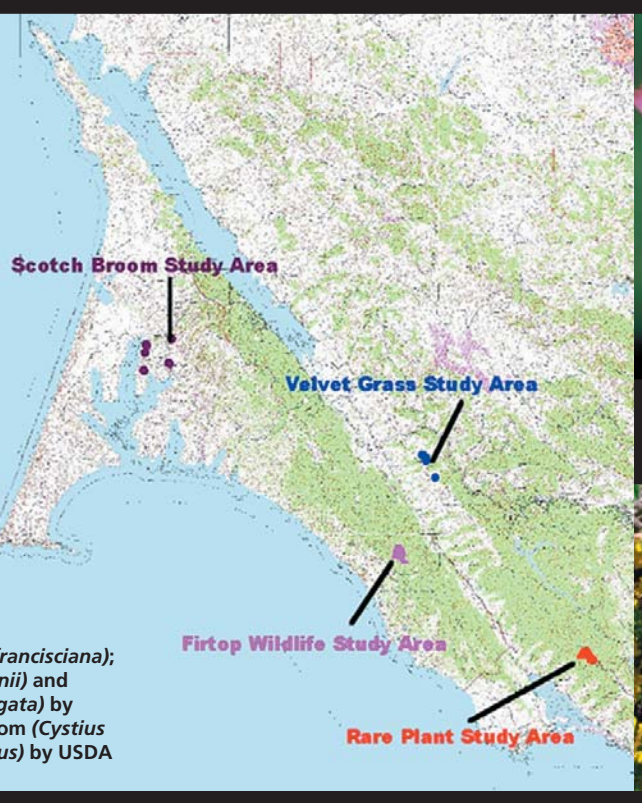
...Many new questions are being asked about fire and biological resources.

Research is increasingly



What are the effects of fire on rare plants?

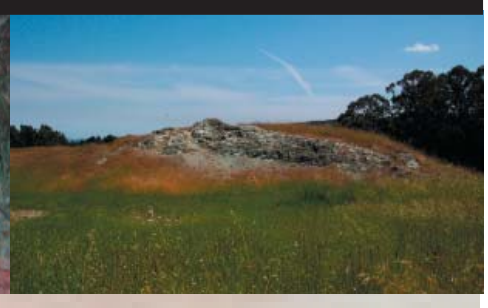
non-native plants?

wildlife?

Plants: **TOP- Presidio clarkia *(Clarkia francisciana)*; Mason's ceanothus *(Ceanothus masonii)* and Marin manzanita *(Arctostophylos virgata)* by Doreen Smith. BOTTOM- Scotch broom *(Cystius scoparius)*; velvet grass *(Holcus lanatus)* by USDA Plants .**

Fire Research

Wildlife: **Fox with prey photographed at Firtop with a motion triggered camera at nite.**



Soils: **Serpentine grassland at Inspiration Point.**

THE USE OF PRESCRIBED FIRE IN national parks presents a number of questions. Can prescribed fire improve habitat for rare or endangered plants? Is prescribed fire an effective treatment for controlling non-native plants or will it increase their populations? How will vertebrate species be effected?

Five fire research projects are being undertaken at Point Reyes National Seashore and Golden Gate NRA based on several criteria:

- Species to be studied occur in areas that would be affected by NPS prescribed burns within the next five years;
- Existing data on fire effects on the species were inconclusive or nonexistent;
- Concerns were raised that prescribed burns may have adverse effects on the species or ecosystem of interest; and
- Studies would be cost-effective (e.g., pre-burn data were already available).

SCOTCH BROOM STUDY - DRAKES ESTERO

Scotch broom is native to the British Isles and central and southern Europe. Cultivation in gardens and along highways as a soil stabilizer has led to its widespread distribution in California, Oregon and Washington where it now covers more than two million acres. Its aggressive spread throughout the northwestern U.S. is due to its: 1) wide tolerance of soil conditions; 2) ability to fix nitrogen; 3) ability to grow during most of the year given adequate precipitation and a mild climate; and 4) abundant production of long lasting viable seeds.

Broom seeds can be viable for up to 30 years leading to accumulation in the seedbank. Research will focus on determining fire intensity and frequency required to kill plants and seeds.

VELVET GRASS STUDY - BOLINAS RIDGE

Velvet grass is a non-native perennial, native to temperate areas of Europe and Asia. It was probably introduced to North America accidentally as a contaminant of forage seed or deliberately as a component of seed mixtures for meadows.

Velvet grass has become a major problem in western Oregon and Washington grassland preserves. Control is difficult due to its prolific seeding ability and broad range of environmental tolerance. Velvet grass populations rapidly expand and crowd out native species, causing a reduction in diversity.

NPS fire monitoring data indicates that fire may cause the spread of velvet grass. Lack of control plots, however, on adjacent unburned velvet grass populations prohibits the use of existing data to answer questions about the effects of fire on velvet grass. Consequently, a research project to determine the effects is being implemented.

The study area also includes stands of native perennial grasses that are typical of intact northern coastal prairie such as purple needlegrass, California brome, California oatgrass, blue wildrye, and Hall's bent grass. Less frequently occurring native perennial grasses in the study area include junegrass, Idaho fescue, and tufted hairgrass. The scarcity of coastal prairie and the potential adverse effect of prescribed burning demonstrate the need for studies comparing the rate and extent of velvet grass spread in the presence and absence of fire.

RARE PLANT STUDY - BOLINAS RIDGE

Mason's ceanothus and Marin manzanita are rare coastal chapparal species. Mason's ceanothus is known only from Bolinas Ridge, and Marin manzanita is known only from Marin County. Both species lack the ability to resprout from the base. Species that lack the ability to resprout from underground structures yet produce fire-resistant or fire-dependent seeds are called obligate seeders. This describes almost all rare and endangered chaparral species.
Obligate seeding species disperse dormant seeds that accumulate in the soil until germination is triggered by environmental changes related to fire. These species are completely dependent on the germination of dormant seed to reestablish their populations. A high germination response may be expected immediately after a fire.

Fire triggered germination cues include heat scarification of seeds, elimination of toxic compounds, chemicals leached from charred wood, and increased light and space.

Species of ceanothus play an important role after a fire because their roots host nitrogen-fixing bacteria. Research will focus on how Mason's ceanothus and Marin manzanita respond to fire as compared to their better known, fire-adapted relatives.

FIRTOP WILDLIFE STUDY - INVERNESS RIDGE

An Inventory and Monitoring (I&M) Program for amphibians, reptiles, small mammals and carnivores was initiated in the Seashore in 1998. The Firtop burn unit includes a wildlife I&M site in Douglas fir habitat with several years of data.

Pre- and post-burn data will be used to assess the effects of fire on vertebrates, including relative abundance, population age structure, habitat preference and associations, weight-length relationships, reproductive status, and population trends.

Traps installed to monitor vertebrates at Firtop have captured twelve vertebrate species: American robin, Bobcat, Coyote, Dog, Fallow deer, Gray fox, Mule deer, Raccoon, Red fox, Steller's jay, Striped skunk, and Turkey vulture. Vertebrates have also been photographed with TrailMaster cameras at the site.

SERPENTINE GRASSLAND STUDY - INSPIRATION POINT, PRESIDIO

One of California's rarest plant communities, serpentine prairie, exists in a small, remnant stand at Inspiration Point in the San Franciso Presidio. At this site, serpentine soils support perennial native bunchgrasses, and serveral rare forbs, including the federally endangered Presidio clarkia, and until its recent extirpation from the site, the federally threatened Marin dwarf flax.

Serpentine soil is derived from serpentinite rock which is found in areas that once were deep ocean plate tectonic spreading centers. These soils often host endemic species due to their unusually high percentage of heavy metals, such as nickel, zinc, manganese and copper, and their low percentage of micronutrients. These soils typically have a calcium / magnesium ratio of less than one, compared to non-serpentine soils which range from 2-10. A ratio of less than 0.2 is exceptionally rare and characterizes the soils at Inspiration Point.

Presidio clarkia is restricted to serpentine soils in San Francisco and Alameda counties, and is the only species of the genus *Clarkia* that is restricted to serpentine. It is most prolific in areas of open vegetation and thin, rocky soil conditions. Non-native annual grasses contribute to the build up of organic debris which changes soil conditions, and promotes the colonization of non-native species. Dead, dry grass also increases fuel loads and is susceptible to wildfire.

The recovery strategy for Presidio clarkia outlined by the U.S. Fish & Wildlife Service suggests creating new habitat by scraping, removing duff, and prescribed burning. A proposed research project to test the effects of prescribed fire on a small section of serpentine grassland at Inspiration Point is currently being evaluated.