After the Fire: Home Garden Soil Management

After a wildfire, soils can be impacted in a number of ways, including chemical and heavy metal contamination, alteration of nutrients, organic matter content, and pH, an increase in erosion hazard, and altered water holding capacity. The cumulative effects of these changes can modify soil productivity and biological diversity, as well as pose health risks to humans and animals. Urban soils are at an increased risk for chemical and heavy metal contamination post-fire because urban environments tend to have features and materials that release these contaminants when burned. **After a wildfire, assess, test, and remediate your home garden soils to reduce the likelihood of exposure to potentially harmful contaminants.**

Step 1: Understand Your Site History

When evaluating your soil post-fire, the first thing to do is understand the history of your site. Visually inspect the area for evidence of impacts. For example, if the site is next to buildings built before 1978, lead may be a potential hazard, especially if you see that the paint is chipped or peeling. Additionally, past land use of the site can be accessed through public records, consulting Sanborn maps or past aerial photographs, or asking neighbors who may have been there before you. If surrounding hazardous materials are identified as potentital sources of contamination, obtaining a soil sample for chemical analysis will help determine the severity of the contamination.

Step 2: Test Your Soil

Testing is critical to understanding how wildfire may have affected your soil. Laboratory soil testing is recommended, especially if the soil is currently being used or is going to be used for urban agriculture. Residents directly impacted by fire can access post-fire soil test results from their clean-up contractor or seek out testing themselves. **DIY soil testing kits are not recommended** for this kind of testing because they cannot test for many contaminants or heavy metals that are of concern post-fire. To learn more about soil testing options, visit UC ANR's Healthy Soils for a Healthy California website (https://ucanr.edu/sites/soils/), the California Environmental Laboratory Accreditation Program (ELAP; https://www.waterboards.ca.gov/drinking_water/certlic/labs/), or contact your local Master Gardeners program.

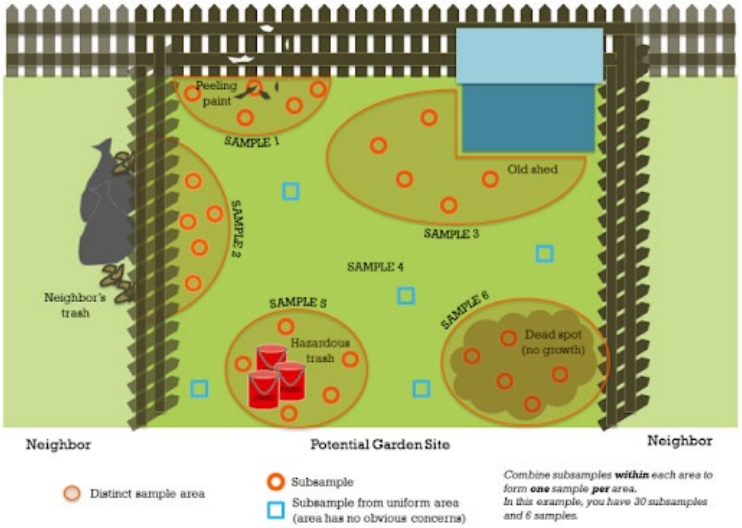

Figure 1: Sampling Plan Map for soil sampling. *PC: Los Angeles County Department of Public Health*

When collecting soil samples for testing, take separate samples from locations with different characteristics throughout the property (Figure 1). Label each sample bag and map sampling locations for your records. This sampling methodology can help determine if any potential contaminants found are localized or widespread across the site. Each bagged sample should be composed of 15-20 subsamples collected throughout your

sampling area.[1] Be sure to mix samples thoroughly in a bucket before placing one pound of soil in a clean, labeled bag. When sampling, wear gloves, boots, eye protection, a long-sleeved shirt and long pants to prevent ingestion and direct contact with potentially contaminated soils.

The U.S. Environmental Protection Agency (U.S. EPA) recommends that for urban areas, "at a minimum, the soil test should include pH, percent organic matter, nutrients, micronutrients, and metals, including lead."[2] This level of testing is adequate for a site that has been residential or a green space. Most commercial soil labs can test for the most important heavy metals, including lead, arsenic, cadmium, chromium, and nickel. More testing may be needed for sites with a history of industrial or commercial use. These sites have the potential to be contaminated by a wider range of heavy metal and polycyclic aromatic hydrocarbon (PAH) contaminants that will require more extensive testing to detect. An EPA-recognized laboratory is the best choice for this level of testing.

Step 3: Remediate Your Soil

After determining the history and state of your soil, the next steps will depend on what your soil testing results indicate. If your soil test indicates that no contaminants have been found exceeding acceptable levels, no immediate action is required for contaminant remediation. Most guidelines on acceptable levels of contaminants are meant for exposure through ingestion or skin contact rather than gardening. However, Table 1 illustrates what ranges of certain chemicals may be acceptable for home gardening. If your soil testing indicates that contaminants have been found at or exceeding acceptable levels, consider the following remediation strategies:

Chemical	Range of maximum levels of chemicals in parts per million (ppm)
Arsenic	.07 to .4
Cadmium and compounds	1.7 to 70
Chromium III	100,000 to 120,000
Chromium VI	17 to 230
Lead and led compounds	80 to 100 (low risk) >100 to 400 (potential risk) 400 – 1200 (potential risk for children) > 1200 (high risk)
Nickel and compounds	1,600
Zinc	23,000

Table 1: Maximum Levels to Guide Interpretation of Soil Test Results
PC: Los Angeles County Department of Public Health

Work with Your Existing Soil

Working with existing soil is most feasible for sites with no history of industrial use and whose soil test results indicate moderate levels of contaminants. **Existing soil should be diluted with quality soil by mixing, maintained at a neutral pH, and amended with appropriate additions of organic matter.**

- Contaminants are often concentrated in the top two inches of soil and can be diluted by digging and mixing the soil deeply and thoroughly.[1]
- Soil pH should be maintained at or close to neutral (6.5-7.0). Soil nutrients are most available to plants at this pH, while lead and some other heavy metals are less available.
- Add organic matter, compost, or clean soil from unaffected areas to your existing soil and continue to do so with each planting that follows. Heavy metal contaminants will bind to organic matter and may become less available to plants. Organic matter also improves soil structure, infiltration, and water-holding capacity, creating a better environment for plant roots.

Use Raised Beds or Other Containers

A common approach for sites with contaminated soil is to install or build raised beds and fill them with clean soil. If building your own frames, use sturdy materials that won't release contaminants into the soil, like redwood or other non-treated lumber, brick, concrete, or rocks. If your raised bed does not have a bottom barrier, consider creating one using various materials (i.e., water-permeable fabrics, rocks, etc.) to separate potentially contaminated soil from imported, clean soil.

Figure 2: Raised beds at Treasure Island Job Corps Farm, San Francisco. *PC: A. Baameur*

- When importing soil, consider purchasing topsoil or planting mix, such as those certified by the Organic Materials Review Institute (OMRI). Local urban farmers or gardeners may have additional recommendations. Some vendors may be able to provide documentation that their soil has been tested. If not, you can send soil samples to the lab for testing.
- Other types of containers besides raised beds can be used as well. Some commercially available examples include growing systems that would be appropriate for smaller-scale projects, and mesh "socks" that are filled with growing medium and placed on top of the soil. Avoid using items as planting containers that could contaminate soil as they degrade over time (e.g., tires).

Remove Contaminated Soil

Soil removal is the most common, yet extreme practice employed when dealing with contaminated soil. This process involves removing the existing soil from your garden site and replacing it with soil that is certified safe. The contaminated soil should be disposed of according to your local regulations or relocated elsewhere in your yard away from your garden site. While this strategy is helpful for assuaging fears of contamination, it isn't necessarily accessible, as it is an expensive process to excavate soil, remove it, and replace it.

Best Management Practices for Near-Home Garden Soil

If you are concerned about inhaling or ingesting chemical contaminants from plants, produce, or soil, use the following best management practices for interacting with soil that has been potentially affected by wildfire:

- **Wear gloves, boots, eye protection, a long-sleeved shirt and long pants** when interacting with contaminated soil to prevent ingestion and direct contact.
- **Use raised garden beds and import clean soils** to avoid inhalation, ingestion, and plant intake of contaminants over time.
- **Amend soil with clean, high-quality compost** to improve soil health. Be mindful to use the appropriate amount of compost.
- **Use mulch to cover the soil** to prevent airborne soil and dust up-splash.
- **Promote good drainage and use drip irrigation to prevent up-splash**, particularly at the bottom of slopes that burned and after long wet periods. Contaminants can accumulate in these areas under wet conditions.
- **Be mindful not to track contaminated soil into your home**.
- **Wash hands before and after harvest and rinse produce before it is consumed.**

References and Additional Resources

[1] Los Angeles County Department of Public Health. (n.d.). Soil and Water Testing Guidelines for Home and Community Gardens. https://ucanr.edu/sites/anrstaff/files/406980.pdf

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Authored by **Isabella Zahra**, UC ANR Fire Network Staff Research Associate
Katie Low, UC ANR Fire Network Coordinator

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With additional feedback from

Ellie Andrews (UCCE), **Andre Biscaro** (UCCE), **Alison Deak** (UCCE), **Mimi Enright** (UCCE), **Tori Norville** (UCCE), **Bruno Pitton** (UCCE), **Julia Van Soelen Kim** (UCCE)

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