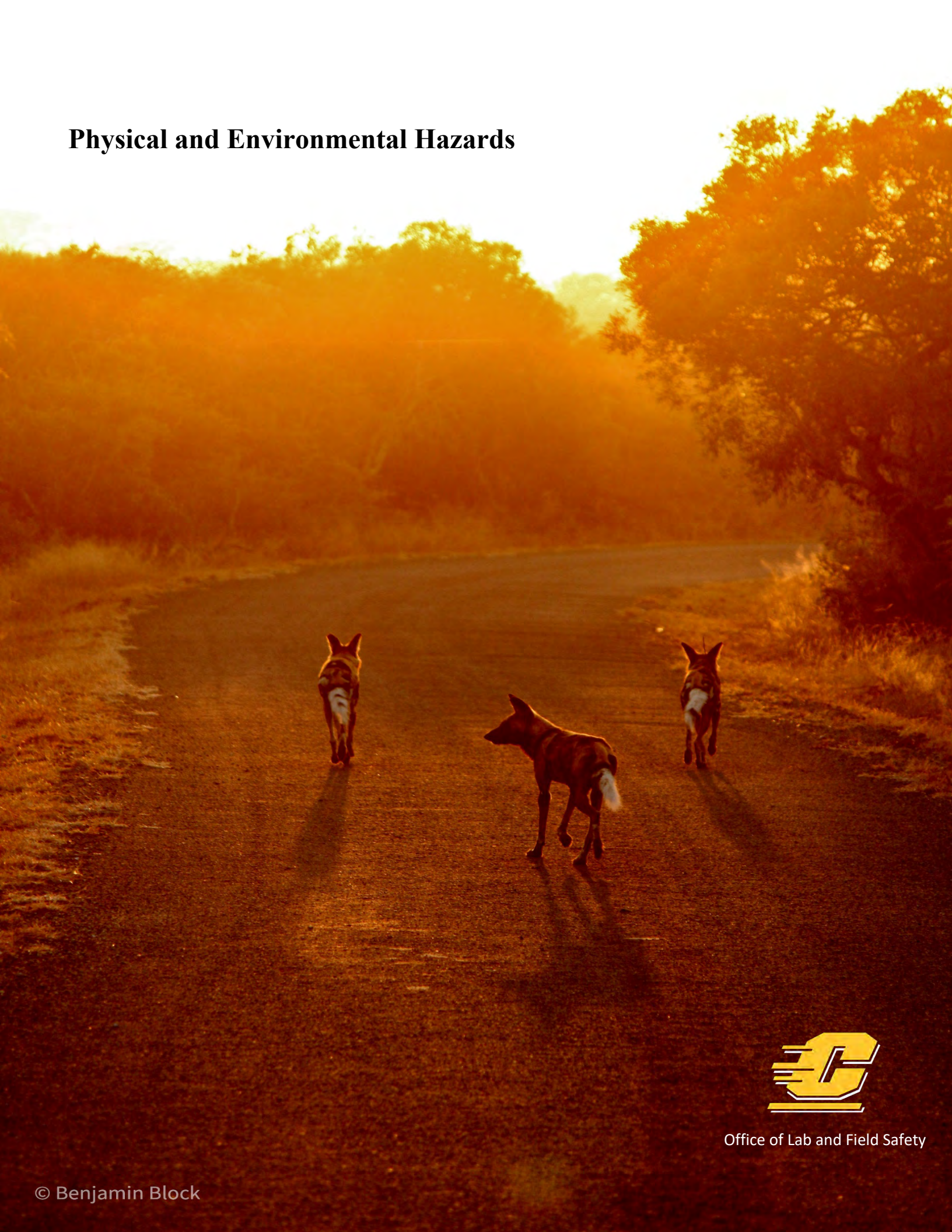


# Physical and Environmental Hazards



Office of Lab and Field Safety

## PHYSICAL AND ENVIRONMENTAL WORK HAZARDS

This document describes the basic hazards and safety requirements for work in various environments.

For information about specific physical and environmental hazards that may be associated with your field work subject and location, consult the Office of Lab and Field Safety webpage

Basic guidelines for reducing the risks associated with some physical and environmental hazards that are commonly encountered on field trips are provided in the following sections:

- A. Weather Considerations
- B. Stopping and Working Along Roadways
- C. Hiking, Backpacking, and Remote Location Work
- D. Climbing, Mountaineering, and Rope Work
- E. Working in Aquatic Environments
- F. Collecting Samples
- G. Working at High Altitudes

### A. Weather Considerations

The primary concern in any outdoor or survival situation is exposure. Becoming wet or unprotected from heat or cold can quickly turn a situation deadly. Preparing for forecasted weather and unexpected changes in that forecast is essential for outdoor activities.

In hot environments, pack extra water and consider bringing a means to filter water if your trip is in a remote location or scheduled to last multiple hours. If possible, plan your route along waterways and shaded areas. You should pack light clothing and avoid leaving skin exposed to the sun without sunscreen. Consider wearing long-sleeve clothing specifically designed for the heat. Take frequent breaks and avoid activity in the hottest part of the day.

In cold environments, wear multiple layers. Add and remove layers as needed and avoid sweating. Do not forget the importance of hydration in cold environments, pack extra water, and consider bringing a filter if traveling remote or for an extended period of time. Plan your route to stay away from the immediate edges of waterways and try to travel and camp in areas that offer protection from wind and snow. Pack extra socks and consider bringing hand warmers, a survival blanket, and other lightweight items capable of keeping you warm and safe in an emergency.



In wet environments, bring adequate protection from precipitation. Becoming wet, even in warmer climates, can lead to hypothermia. Waterproof jackets are different and more effective than water resistant gear and should be packed when possible. On day trips where rain is likely, or on multiple day expeditions, rain pants and waterproof footwear should be worn.

## B. Stopping and Working along Roadways



Stopping along public roadways is dangerous to researchers and students participating in field work. When possible, use existing pullouts, parking lots, or other designated parking spaces. Drivers should be certain that it is legal to pull off the roadway and park on the shoulder. When existing pullouts, etc. are not available, and the situation is not an emergency, drivers should not stop unless safe and adequate shoulder space is present.

*Safe* shoulder space is one that allows a slow and stable exit from the roadway without presenting a hazard to other vehicles, one that is not sloped away from the roadway to any degree that would cause harm or excessive exertion to students leaving or entering the vehicle, that would place the vehicle in a rollover situation, or that has the potential for the vehicle to sink into the shoulder.

*Adequate* shoulder space is defined by a shoulder area width that can safely accommodate the maximum width of the vehicle including the extra width of doors that open towards the roadway and as shoulder area length that will accommodate the safe parking of all vehicles involved in the field trip.



If a vehicle must be stopped on a paved or unpaved shoulder along any roadway, the vehicle driver is responsible for turning on the vehicle's emergency flashers. The driver should also deploy traffic cones or road flares if possible. Parking on tight curves where visibility is reduced for other traffic, or on bridges where lanes are narrow, must be avoided.

When parking along a roadway to conduct sampling, remain vigilant for other non-traffic related hazards. For example, if sampling roadside rock cuts, park the vehicle well away from any overhead outcroppings to prevent damage to the vehicle from falling rocks. If sampling a waterway at a road crossing, park the vehicle away from the edges of the waterway or attached ditches and tributaries to avoid sinking in soft mud. Whenever working alongside a roadway, consider making or purchasing a sign that can be placed down the roadway, alerting oncoming motorists to your presence.

All personnel involved in a stop along a public road must stay off the road to the maximum extent possible, and must remain vigilant for oncoming traffic. On sparsely traveled highways, oncoming vehicles should be announced to the group to give needed time to move away from the roadway. On heavily trafficked roads, personnel should constantly remain as far away from the road as possible and preferably behind any guardrails present.

## C. Hiking, Backpacking, and Remote Work



Hiking, backpacking, and remote work present multiple safety challenges that are often overlooked. Luckily, these hazards can be overcome with forethought and proper planning. Emergency preparation, backcountry safety, and emergency situation management are addressed in greater depth in other field safety documents available on the OLFS web page.

### 1. General Safety Rules

The following rules should always be followed when conducting field activities, especially in remote or isolated places.

- a. **Inform Someone.** Always inform someone responsible, who is not involved in your trip, about where you are going, when, for how long, with whom, and for what purpose. Give them a departure time, a proposed return time, and a time to contact emergency services if they do not hear from you. Always inform someone of your plans, even if you are just going for a 'harmless' jog or hike in the wilderness. Countless lives have been lost on mundane trips that went wrong because no one knew where the victim went.
- b. **Communication Plan.** Always have more than one form of communication when conducting remote field work. Cell phones, radios, satellite phones, emergency beacons, walking out, and signaling devices can all fail. It is best practice to have at least one back up communication plan when in remote locations.
- c. **Consider carrying a field survival kit.** This is a small bag you can prepare at low cost. It should include the basics for survival such as two methods of fire starting, two methods of water purification, a means of shelter/element protection, a way to signal for help, and a navigational aid.
- d. **Navigation Plan.** Always thoroughly research your route and field location using topographic maps and GPS data. Know what direction you would need to hike to reach the nearest help. Always bring a map and compass. If possible, bring a GPS unit.
- e. **Shelter and Water.** Consider bringing a means of shelter and water purification even on day trips. Mylar survival blankets and pocket filters/purification tablets weigh mere ounces and can save your life in an emergency.

## 2. Slips, Trips, and Falls

- a. Even a small tumble can generate catastrophic results. A sprained ankle can jeopardize a research project. A broken foot in remote territory can leave one stranded for days, potentially without shelter, water, or a way to call for help. A more severe fall resulting in a fractured or broken limb can result in shock and death. Do not underestimate the ease with which the human body can be damaged, even seemingly benign terrain can result in crippling breaks and tears that could have cataclysmic results if you are not prepared.

Wear footwear appropriate for the terrain. Study topographic maps before departing to identify potentially hazardous terrain. Investigate the condition of trails before arrival. Bring trekking poles or walking sticks to assist with balancing and traversing difficult territory. Consider packing items to assist with the treatment of these injuries, such as ACE bandages and SAM splints.

## 3. Lost

- a. Becoming lost in the wilderness happens quickly. You can easily become lost in areas with dense vegetation, mountainous terrain, degraded trail systems, high levels of animal activity, and other navigational challenges. Being lost without a sense of the surrounding cartography and void of a navigational aid can be a death sentence.



Always formulate a PACE plan for navigation before entering the wilderness. Remain calm and collected if you become lost as panic robs the mind of critical thinking skills. Understand how to use multiple navigational aids such as compasses, maps, GPS systems, dead reckoning, celestial navigation, and more. Carry a means of signaling rescue teams such as a mirror, whistle, flare, fire starter, etc.

## 4. Medical Emergency

- a. The dangers presented by many medical emergencies substantially increase when they occur in remote locations. The threat of permanent impairment or death increases with each minute that passes without treatment. Even ailments that are treatable in the field may need immediate medical care. For example, the life-saving effects of an Epi-Pen can dissipate after only 10-20 minutes, and the victim may fall back into anaphylactic shock. Field operators must be prepared to treat medical emergencies to the best of their ability and quickly deliver the victim to medical professionals

## 5. Hunting

- a. The majority of American states and many foreign nations engage in a variety of hunting seasons that often span many months. When conducting field operations during hunting season, workers must be extra cognizant and cautious. Accidental shootings and encounters with disgruntled hunters may occur.

Familiarize yourself with the hunting seasons and regulations that impact your research area. If possible, avoid your research area during hunting seasons.

Remain cognizant of your surroundings when entering and leaving your work area during hunting season. Do not enter your work location if there is evidence that a hunter is currently in the area. Wear bright, reflective clothing at all times. Interact with any and all strangers in a friendly tone, maintain a calm demeanor even if you are harangued. Contact the local police, game warden, or fish and wildlife if you feel threatened or witness illegal hunting activity. Lastly, consider carrying a first aid kit complete with a tourniquet, packing gauze, pressure bandages, and other life-saving elements.

6. Extreme Weather Events

- a. Some research locations may possess the potential for catastrophic events such as avalanches, landslides, earthquakes, tsunamis, flash floods, and more. Each of these events possess unique elements of preparation and prevention that must be analyzed before beginning work.

7. Animal Interactions

- a. The probability of a dangerous encounter with a wild animal often depends on the location of one's research. Contact with poisonous plants and dangerous microorganisms also varies depending on location. Descriptions of hazards plants and animals and their observed ranges can be found in the [Duke University Safety Guidelines for Fieldwork document](#).



8. Criminal Activity

- a. Drug and illegal operations, robbery, exploitation, kidnapping, and other criminal activities pose a threat to researchers in many locations. Familiarize yourself with the signs of these activities and, if you encounter them, quietly and quickly leave the area. Report what you have found to law enforcement once you are safe.



## D. Climbing, Mountaineering, and Rope Work

The climbing, mountaineering, or navigation of sheer faces, steep slopes, rock outcroppings, etc. must be conducted by trained individuals. Anyone pursuing field work that requires technical climbing must provide evidence of their completion of climbing school or possession of other certifications that confirm their ability. Do not allow students or researchers to climb or descend hazardous slopes and formations unless paramount to the immediate safety of the individual or others..

1. General Safety Rules
  - a. Only perform technical climbing (i.e. bouldering, rope climbing, etc.) if certified.
  - b. Only climb or descend steep slopes or drops if:
    - i. Approved to do so under your research project.
    - ii. Necessary for the safety/survival of team members.
  - c. Wear proper footwear when negotiating steep terrain (i.e. while hiking).
  - d. Plan your ascent and descent before you begin a climb.

## E. Working at High Altitudes

Research conducted at altitudes greater than 8,000 feet exposes researchers to the dangers of altitude sickness, high-altitude cerebral edema, high-altitude pulmonary edema, increased exposure to cold and the elements, severe weather (blizzards, thunderstorms, etc.) and a variety of other hazards discussed in greater depth here. Researchers should be medically cleared before working at high altitudes and should consider accessing altitude sickness medication.

## F. Working in Aquatic Environments

The hazards of working in aquatic environments are thoroughly addressed in the Aquatic Work Hazards document.

## G. Sample Collection

Before departing on a trip, the collection, preservation, and transportation of field samples must be planned. The PPE required for your job will vary depending on location, weather, time, tools used, materials sampled, and more.

For example, when collecting rock samples, safety glasses with side shields and an ANSI Z87 approval, face shields, gloves, closed toed shoes, clothing that covers exposed skin, and ear protection may all be needed. The specific methods of collection may change the specific PPE required. A jackhammer may require double hearing protection while a rock hammer may require none. Similarly, if the samples will be stored in chemicals or chemically analyzed in the field, researchers should also have chemically protective gloves to use.

Choose your PPE based on your collection plan around understand that the requirements may need alteration even if something as simple as the weather changes.

