Disaster Strikes

FOREST FIRES

Life is short. Forest animals don't need us to make it shorter. Their lives are in our hands. When the trees and grass grow dry as tinder, will you be the one to leave burning embers at the campground?—to carelessly flick a lighted match into the underbrush?—to set a little "fun fire?"

Fun fire? There's no such thing. Even "contained" fires can get out of hand and grow like fury. A few smouldering twigs can become a rampaging blaze. A single careless toss can turn the forest world into wholesale horror. Fire destroys: burrows, nests, seeds, roots, hunting territories, mating grounds—*life*.

It takes no more than one fool to start a fire. It often takes an army of cool heads to put one out.

Man is responsible for 58% of all forest fires—and about one-third of that number are set on purpose! And people who take to the woods for recreation are responsible for one-third of all forest fires each year. So stay alert—or stay home.

Lightning causes many forest fires too, but when it strikes—whamo!—it often happens on top of a hill, where the temperature is cooler, the fuel supply is sparse, and the flames are more easily spotted.

Manmade fires, whether the culprit is an arsonist, or simply careless, usually occur in low-lying places, along trails and roads. This gives the blaze a good chance to take hold and cause a heavy toll.

An arsonist will choose a secluded place, and weather that's hot, dry, and windy. This sort of fire will spread rapidly, fed by updrafts. Forests grow slowly. Forest fires grow fast.

Animals caught by a forest fire can't outrun the flames. Think about them on your next trip, and rake the ashes of your camp fire extra carefully. You'll be glad. So will they.

The ravaging flame is often only the beginning of the destructive effects of a forest fire: A heavy California mountain rainfall roared down two canyons. The one that was forested, and covered with chapparal, naturally absorbed the water. The one that was bare, its trees and shrubs previously devastated by fire, had nothing to hold back the water, which cascaded down the canyon, deluging the town cradled in the valley, sweeping away two hundred houses and killing 34 people. Be careful. Fire kills in far-reaching ways.

Three kinds of fires can destroy the forest:

A *surface fire* burns along the floor of the forest. It is usually slow-moving and close to the ground, but it can spread fast. It kills small trees and either kills or permanently damages larger trees. Most fires are of this type.

A *ground fire* burns on or below the forest floor. These fires are often started by lightning. They move slowly, and often go undetected for weeks. They are hard to put out. The heat they create beneath the ground destroys the trees' roots and any chance for life.

A *crown fire* moves faster than most people can run. These often start as surface fires, and are blown by winds into the tree crowns. Fir forests are especially vulnerable. The needles and cones catch fire easily and quickly. A grove of trees "topping out" in this way is doomed.

A fire has to be fed, or it dies. If you want to kill one fast, cut off its supplies: *1. HEAT 2. FUEL 3. AIR.*

The main elements which influence the spread of a fire are *fuel, weather,* and *slope.* Fast-burning fuels are dry grass, dead leaves and tree needles, brush and small trees. These are called *light fuels.* Slow-burning fuels are logs, stumps, branchwood, and topsoil. These are *heavy fuels.*

Weather factors are wind, moisture, and temperature. Generally, the stronger the wind, the drier the air and the higher the temperature, the worse the fire problem.

High-intensity fires shoot flames 150 feet into the air. Tornado-like firewhirls spew flashes 600 feet high. A fire may spread anywhere from a few feet in a few weeks to 30 miles in an hour.

The Peshtigo Fire in 1871 took more lives than any other in the United States. Almost 1,500 people were killed and 4 million acres burned. In October of 1952, fires in Kentucky and West Virginia burned 2 million acres. In 1957, Alaska lost 5 million acres of green forest. In the decade that ended in 1961, the U.S. Forest Service recorded 1,300,000 forest fires in the United States. A total of over 70 million acres burned. In 1966, almost 286,000 acres of national forest burned.

While much is being done to update and improve firefighting, including methods of prediction, detection, and control, you must be able to do your part, too —by knowing how to prevent destructive fires from starting.

SOME BASIC FIRE PREVENTION RULES

Don't just throw that match away. Snap it in two, hold it until it's cool. Better yet, dunk it in water, or grind it into the dirt with your heel.

Crush all cigarette stubs thoroughly to be sure they're out. Then put the butt in an ashtray or empty can. Never throw a cigarette out your car window. Never drop it on a path or roadway.

Do not start campfires on private lands, or in any place where signs say "No Fires."

Where it's legal to build a campfire, make sure it's a safe one. Avoid areas of brush, thickets, or timber. An open, treeless spot, near water, is an ideal place for a fire. Scrape away all dry leaves, bark, wood, pine needles, grass, and any other tinder to make a circle of bare dirt at least 6 feet in diameter. Surround it with rocks, and build your fire in the center. You can use the scrapings for fuel.

Keep your fire small and stay with it.

Before you leave your campsite, drown your fire. Stir the coals and pour water over all. Stir again and douse again. Turn over smoldering logs and soak both sides. Wet the ground thoroughly all around the fire.

Burning trash is illegal in many places. Check it out. When burning trash on your own property, do it only on calm days, in either an incinerator or a metal can. Have water and tools on hand, and a friend nearby to help. Squelch every straying spark.

If you start or spot a fire, call the fire department, the police, or a ranger immediately. Don't give the flames a head start.

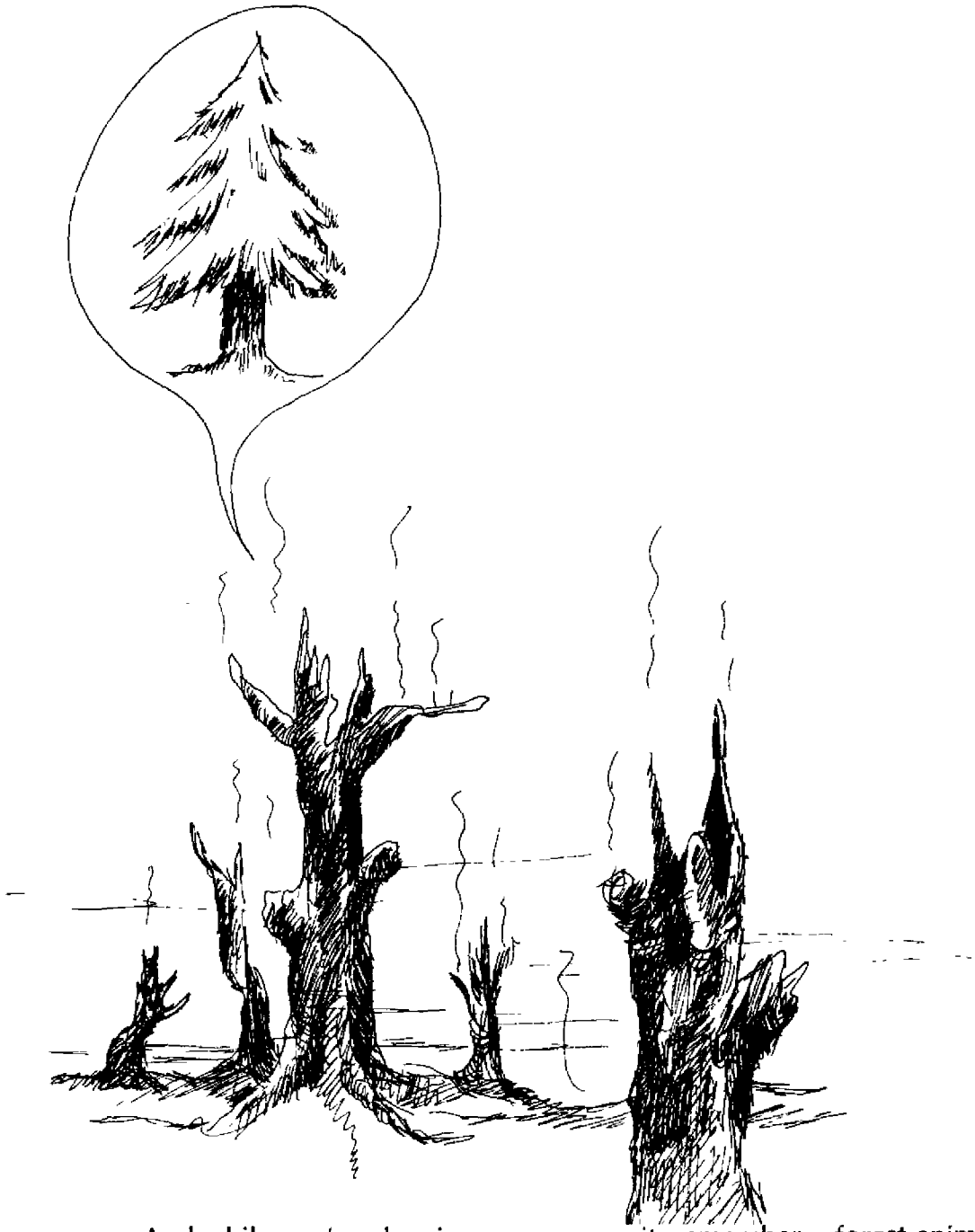
Fires spread *uphill* and *downwind*. If you encounter a fire, try to run across its path and out of its way. Get behind it or beside its flank. Don't try to outrun it. That's one race you can't afford to lose.

If you live in a forest fire area, make a safety plan.

1 *Decide which escape routes you'll use.*

2 *Decide on a possible sanctuary where you can wait out the fire.*

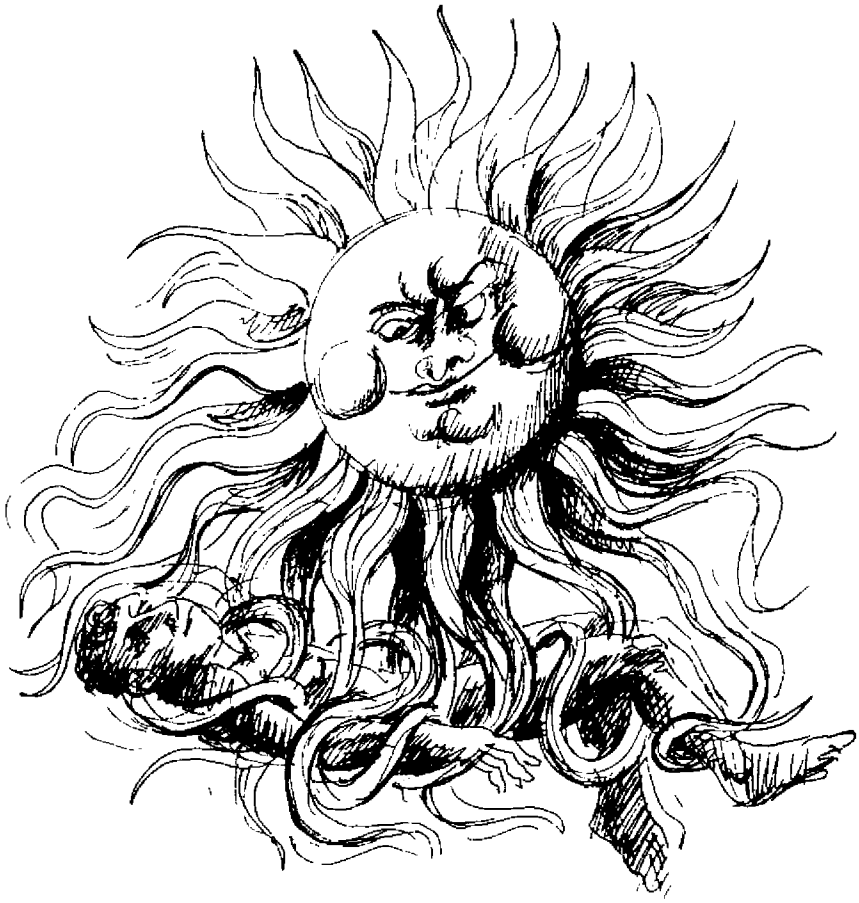
3 *Come to an agreement on what factors will mean "That's it, let's go!"*



And while you're planning your own exit, remember—forest animals don't have one. Their only escape is our good sense.

Parks are becoming our last chance to get out into nature. Some say the more contact we have with nature, the better our chances of being whole people. But use the opportunities sensibly.

"Lady bug, lady bug, fly away home—your house is on fire, and your children . . . ." Only caring—the simple human variety—can prevent broken homes, and burnt out hope.



HEAT WAVES

ONE SUMMER FRAN'S SIBLING, NAMED PETE,
WAS TOTALLY ZAPPED BY THE HEAT.
MY GOODNESS, SAID SHE,
I AM SOBERED TO SEE,
A PUDDLE WHERE PETE USED TO BE.

"In addition to their odd appearance, as you can see from Figure 3 on page 14 of your books, earthlings are distinguished by a variety of quirks. They are susceptible to—ah—shall we say—ah—termination, by factors so numerous that their continuation as a species is miraculous."

Professor Quantle paused, and looked slowly around the classroom. "Our superiority is so obvious I won't waste our time discussing it. I will turn instead to thoughts of our coming 'visitation'," he chuckled. His little sensor mechanisms waved gently. "We plan to arrive in Devil's Elbow, Missouri, in what they call July, as you all know. Now this time of year, which earthlings fondly refer to as 'summer,' should cause us no problems. Like almost everything else, however, it does cause *them* problems. They are pathetically delicate."

His class shook their heads in varying expressions of sympathy. The room was full of bobbing sensors.

He continued, "Earthquakes shake them up; winds blow them; microbes attack them; fire burns them; and sand buries them. Winter freezes them and summer wilts them. Actually," he muttered, "I don't think anything is very fond of them. Their ability to survive, despite such frailty, is scientifically quite fascinating. Let's examine the hazard they are most likely to face in the Northern Hemisphere in July: the heat wave.

"The source of heat on earth is the sun. If the sun were to grow cooler, the earth would freeze; hotter, it would frizzle. But even with this ideal balance, the sun poses a hazard. It can make earthlings ill, even—ah—terminate them. Let us take Americans, for instance."

There was a mild murmur of boredom from the class. "Now, now," said the instructor, "be gracious. In most years, an average of 175 Americans die from summer heat and too much sun, what they call 'excessive heat and insolation.' Of all their natural hazards, only the extreme cold of winter takes a heavier toll. Of course their natural hazards are petty compared with the unnatural horrors they invent for themselves, but that subject will be covered in depth in 'Earthlings 1B.' Now we will simply concentrate on the heat problem.

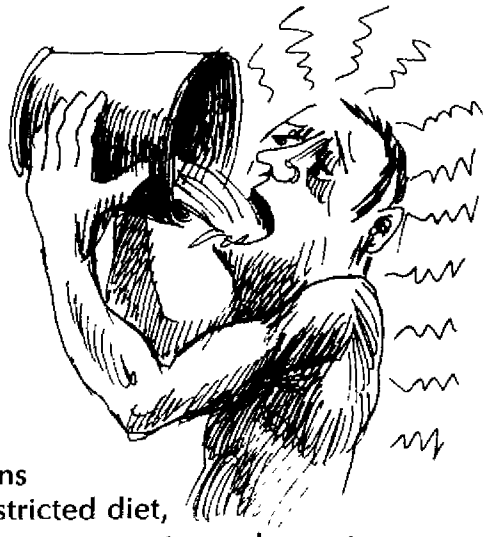
"Actual heat waves killed more than 8,000 people in the United States between 1950 and 1967. These are direct casualties. No one knows how many deaths are helped along by extreme heat or sun. Heat waves are a source of heavy stress to the human body, especially the very old or weak or sick.

"The heat wave of July, 1966, hit much of the eastern and middle continent with high temperatures and extreme humidity. St. Louis, Missouri, for example, near where we plan to land, was the scene of 246 deaths caused primarily by heat.

"Humans seems to enjoy hot weather enormously, and if they take certain protective measures, their delicate constitutions do not suffer unduly. I have managed," Quantle beamed, "to procure a list of rules and regulations they apparently must heed to escape the worst consequences of the heat. Perhaps you'd care to look them over. Oogle, would you kindly?"

As Oogle passed out Quantle's list, the Professor went on: "When earthlings follow these rules, they are far less likely to be disabled by heat sickness. But many of them are not overly intelligent, and some of them are foolhardy. Our mission, of course, is purely investigative, but as we are somewhat morally advanced, and intend to conduct ourselves with goodwill, a general preparedness for dealing with any cases of earthling collapse we may encounter will be helpful.

"I have prepared a summary of heat ailments, and their remedies. You may find it useful. You may even want to leave a few around down there, on doorsteps, or in mailboxes. Surreptitiously of course." Quantle smiled. "Just use your quaggles," he said.



Surviving the Sun

Rules sometimes are a drag. But in a heat wave, you'll be glad you have some.

1 Slow down. High temperatures and humidity sap your energy, and put a strain on your heart. Listen to your body. If it says "go loll in the shade, friend,"—go loll.
2 Don't dry out. Excessive perspiration will make you thirsty. Obey your body—drink up. Take a salt tablet: sweating drains your normal supply, and you need it. If you are on a salt-restricted diet, of course, ask the advice of your doctor. Overuse of tablets may cause stomach upset.
3 Dress in lightweight, light-colored clothes. Light colors throw back the sun's rays. Take a tip from the Tuaregs, the dwellers of western and central Sahara. When the sun sears, they wear white cotton undergarments, and envelop themselves in white cotton or woolen cloaks, covering their heads and lower faces.
4 In a real heat wave, the best defense is to be where the heat is not. Find an air-conditioner, take in a cool movie, go shopping where they have chilled air. If you can't find air-conditioning, get out of the sun. Even a slightly stuffy room is better than stinging rays. The effects of heat exhaustion mount up. You are more likely to be in a worse way on Thursday of a heat wave than you were on Monday.
5 Don't overeat. You probably won't feel like it anyway, but stay away from heavy foods. Light salads, fruit, cottage cheese, and lots of liquids are good for you, and don't take unnecessary energy to digest.
6 Make it easy on yourself. Even on moderately hot days, ration your sun-worshipping: 5 or 10 minutes the first day, and add to it slowly. Sunburn is very painful. You probably won't die from it, but it may make you want to.
7 Pray for rain. Or snow.

Professor Quantle's Rules for Helping Heatstruck Humans

CAUTION: If any of the effects discussed below are severe, call for emergency help, or go to a doctor or emergency room.

Sunburn

When people try to cram a week's vacation into a sunny 24 hours, or if they simply fall asleep in the sun, they can expect a burn—just as real and painful as a fire burn. The skin becomes red and sore, and there may be swelling and blisters, and possibly a headache and fever.

Remedy: Take an aspirin, lie in a cool room. Soak the affected parts in cool water. For a mild sunburn, apply a sunburn remedy, cold cream, or shortening, with clean hands. Don't use butter or margarine; the salt in them may prove painful. Stay out of the sun until your burn is gone.

Heat Asthenia, or Loss of Strength

When the weather is hot and humid, one may feel generally tired, and have trouble concentrating, eating, sleeping, and breathing; one may also sweat heavily, and have a faster pulse than normal.

Remedy: Try to get into a cooler spot, perhaps a store or a movie. Drink lots of water, take a salt tablet (as long as you're not on a salt-free diet), rest as much as you can.

Heat Cramps

Strenuous activity in the heat often results in painful muscle spasms in fingers, arms, legs, and in the abdominal wall (stomach cramps). The pupils dilate with each spasm. The skin is cold and clammy, and there may be heavy sweating.

Remedy: Apply firm pressure on cramping muscles, with warm, wet towels. Drink plenty of liquids, and one-half teaspoon of salt in 4 fluid oz. of water at 15-minute intervals; one or two doses may be all that is required.

Heat Exhaustion

Long spells of high temperatures, too much exposure, and physical effort, can result in profuse sweating, weakness, vertigo, and heat cramps. These may be followed by heat exhaustion. The skin grows cold, pale and clammy, the pulse is weak, and blood pressure is low. Body temperature may go below normal. Vomiting may occur.

Remedy: Get to a cooler environment immediately; take a cool shower or bath if nothing else is available. Rest, plenty of liquids, and salt to replace depleted supplies (one-half teaspoon in 4 oz. of water) are essential. In severe cases, call a doctor.

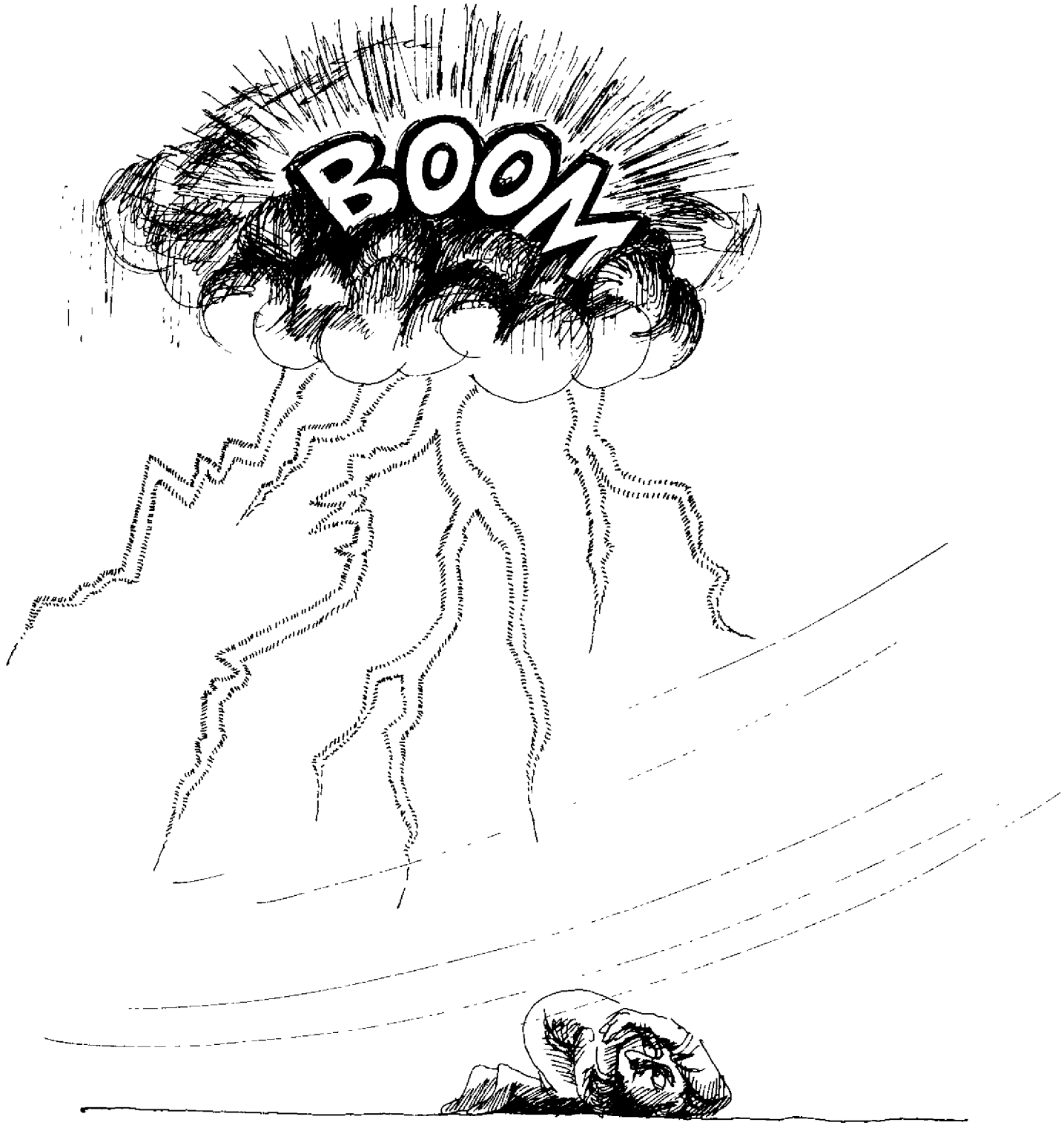
Heat or Sun Stroke

In old and infirm people, overwhelming heat restricts sweating. Nausea, weakness, headaches, and cramps may occur. The body temperature may rise to 106° F.—the pulse pounding, blood pressure high. Armpits and groins are dry, skin is initially flushed, but later ashen or purplish. Delirium or coma is common.

Remedy: Heat stroke is an emergency. Medical care is crucial. While waiting for emergency assistance, reduce temperature by cold bath, sponging with alcohol or water, until temperature and pulse rate come down. Delay in proper treatment can cause death. If you can't get a doctor, take victim to the hospital immediately.

"Having imprinted these two lists," Professor Quantle said, "you may have concluded that summer on earth is a grim time. Actually, for most earthlings, it's the best time—life is full and easy, people are more active; children swim, go barefoot, pick fruit from trees; people stay up later, eat outdoors, go on vacations." Quantle sighed nostalgically. "It's just that, though *we* have nothing to fear from summer, almost everything poses a hazard to *humans*. They can brain themselves with a can of peaches, choke to death on a pin-sized fishbone. Keep in mind how vulnerable they are.

"Before class is dismissed, I should like to wish all of you luck on your interplanetary journey, and counsel patience. Remember, humans tend to attack what they do not recognize. Be tolerant, duck if they shoot—and remember in moments of annoyance that at some primitive time in your evolution, you too may have been human. Just be glad it's all behind you.


BOOM

It was an ordinary night on the farm, as July nights go, and Ralph and Marvin were bored. There's very little to do after 6 o'clock in the evening when you're a pig, which Marvin and Ralph were. They had finished the last bit of their dinner, and then they had discussed the day's activities, but it was a slow day around the pen.

Just now Ralph was saying he thought he was developing a touch of rheumatism, but his heart wasn't in what he was saying to Marvin. He was distracted by the oppressive quality of the evening.

The sky was heavy and it was hot. It reminded Ralph of a similar night when he was a piglet, though it wasn't a clear image. He thought he remembered lots of yelling and running around, and broken lumber all over the yard. His best friend, Evy the goose, had been killed by a piece of flying timber. Her husband, Bill, had lost all his feathers in the violent wind, and had wandered about for weeks shivering and honking pathetically.

Ralph didn't even like to think about it.

Just then, Mr. Person came strolling down from the main house. "Elsie," he called, "They say over the radio there's a tornado watch on."

"Can't hear you," his wife yelled, emerging from back of the barn. "Did you say a tornado warning?"

"No," said Mr. Person. "I said a tornado watch. A *tornado watch* means tornado formation is likely. A *tornado warning* means one has been seen or indicated by weather radar."

"Oh," sighed Mrs. Person, "then it's all right."

"I wouldn't say that," replied her husband. "It's heavy thunderstorm weather. That can mean tornadoes, lightning, and flash floods. We're in for trouble I'll bet."

Ralph shivered. "I w-wish I could k-keep a cool head in a c-catastrophe," he sighed, looking helplessly at Marvin.

Marvin looked at Ralph with compassion. "You are beautiful, but I am brave. I really shine in an emergency," he added.

"That's true," sighed Ralph. "I am lovely, but a dismal c-coward. I will put myself entirely in your hands. What shall we do?"

"First," said Marvin, "I'll tell you the rules I learned in school. Be cautious, but not panicky. If we had a radio, we would know what the storm is doing. But we can at least tell when a thunderstorm is maturing if we feel a *sudden reversal of wind direction*, a *noticeable rise in wind speed*, and a *sharp drop in temperature*. I will educate you on the various characteristics of thunderstorm safety tonight. First let's cover tornadoes, since one seems possible." Marvin cleared his throat.

Tornadoes

"We need to know the following:

1 In open country, move away from a tornado's path at right angles. If there is no time to escape, lie flat in the nearest ditch or ravine.

2 Structures with wide, freespan roofs like auditoriums, gymnasiums and schools which don't have reinforced construction are unsafe. Go to a nearby building of reinforced construction instead, or take cover outside on low, protected ground.

3 In homes, the basement is the safest place. Seek shelter under sturdy furniture if possible. If the nearest house has no basement, take cover in the center of the house, on the lowest floor, in a small room like a closet or bathroom, under sturdy furniture. Keep some windows open to help equalize pressure, but stay away from them because they may shatter.

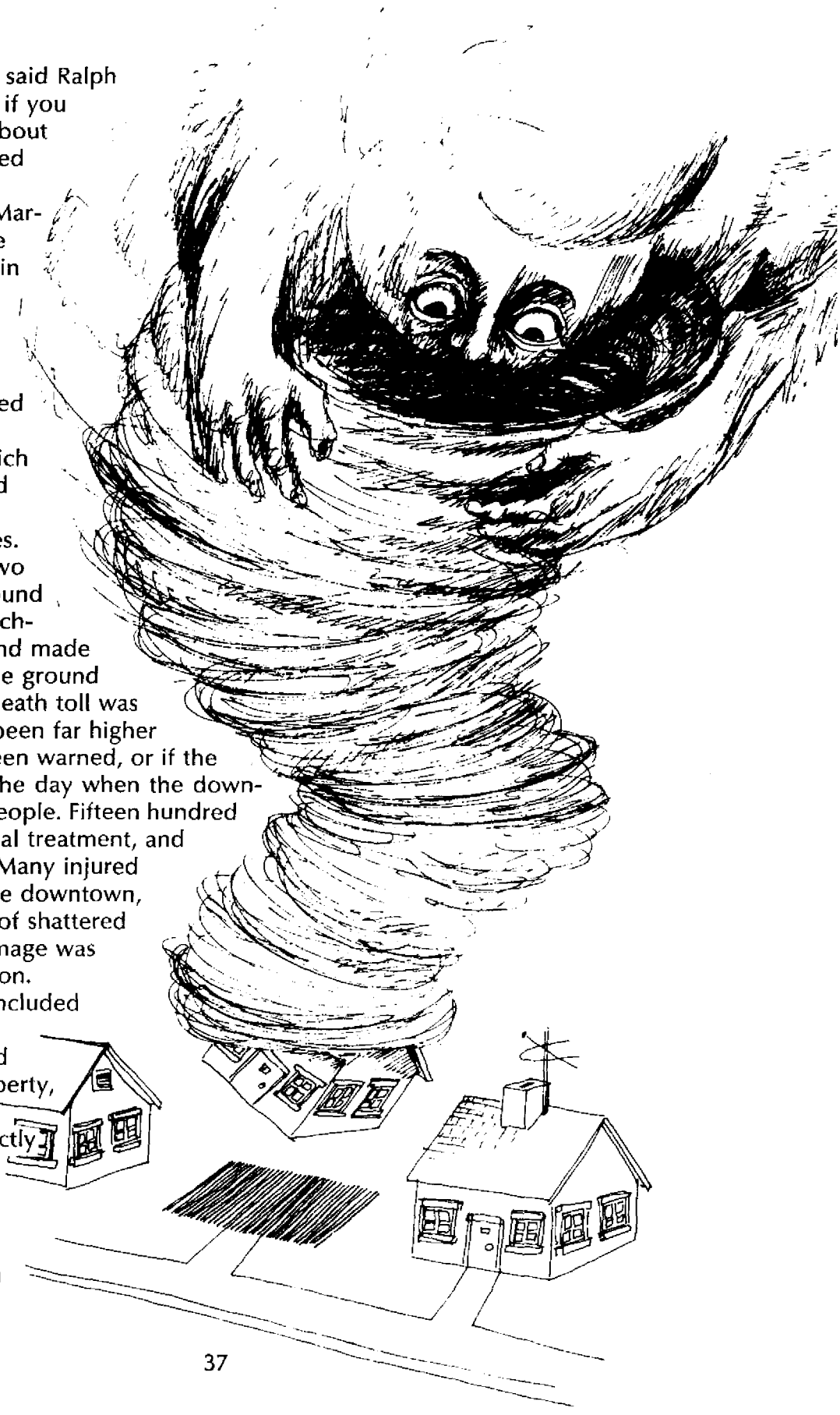
4 In shopping centers, people should go to a designated shelter area; a car is an unsafe place to be.

5 In office buildings, go to an interior hallway on the lowest floor or to a designated shelter area.

6 Mobile homes are specially dangerous during strong winds, and should be evacuated when strong winds are forecast. You can minimize destruction by securing them with cables or tie-down straps anchored in concrete footing, or with screw anchors in the soil. Mobile home parks should have a community storm shelter, and someone to monitor broadcasts during a severe storm. If there is no shelter nearby, leave the trailer park and take cover elsewhere.

"Excuse me," said Ralph timidly, "but I wonder if you could tell me a story about a tornado you have lived through."

"Sure," said Marvin expansively. "I'd be delighted. I was living in Lubbock, Texas, at the time. It was late spring —actually May 11, I believe—in the year 1970. The storm wrecked most of the northeast quarter of the city, which has 150,000 people and extends over an area roughly 10 by 8½ miles. This particular night, two tornadoes touched ground to the east of Texas Technological University, and made broken contact with the ground during their trip. The death toll was 26, which could have been far higher if the people hadn't been warned, or if the storm had hit during the day when the downtown area was full of people. Fifteen hundred people received medical treatment, and 96 were hospitalized. Many injured people, especially those downtown, were hit by fragments of shattered windows. Property damage was estimated at $200 million. Fortunately, I am not included in that figure."



"Marvin," said Ralph, "you aren't property, you're a pig."

"You're perfectly right," said Marvin. "That's very true. But people often think in rather limited terms."

"I don't mean to sound stupid," said

Marvin, "but could you tell me what a tornado actually is?"

"Actually," said Marvin, "a tornado is a column of air that rotates violently. Tornadoes descend from cumulonimbus or thunderstorm cloud systems. The vortex of a tornado is normally several hundred yards in diameter and contains winds estimated at over 300 m.p.h. Tornadoes happen on all continents, at any time of year, any hour of the day, but most occur in the United States. Their most frequent appearance in this country is in the spring, during the middle and late afternoon. Tornadoes are of short duration, but they're the most violent of all atmospheric phenomena. On the average, their paths are only a quarter of a mile wide, and only 16 miles long.

"Tornadoes form several thousand feet above the earth's surface, usually during warm, humid, unsettled weather, and in concert with a severe thunderstorm. A parent thunderstorm can spawn several tornadoes. The forward speed of tornadoes can range from almost no forward motion to 70 m.p.h."

"It all sounds rather furious," said Ralph.

"It is," said Marvin. The very best place for tornadoes to form is the continental plains of North America. In February, when tornadoes become more frequent, the center of activity is over the central Gulf States. Then during March, this center moves east to the southeast Atlantic States, where tornadoes are most numerous in April. During May, tornadoes are more frequent in the southern Plains States, and in June, north to the northern plains and the Great Lakes area, all the way to western New York State. Winter offers few encounters between warm and overriding cold systems, so tornadoes are at a low ebb by December. I hope that answers most of your questions."

"I do have one," said Ralph hesitantly. "I have heard that these winds have a sort of whirlpool structure. Is that true?"

"Why, yes," answered Marvin. "Where did you learn that?"

"Oh," said Ralph, "it's part of a government pamphlet I found in my lunch."

Lightning

"The second thing on the agenda tonight is lightning," continued Marvin. "Did you know, Ralph, that the average yearly death toll for lightning is greater than for tornadoes or hurricanes?"

"Actually I didn't," said Ralph.

"According to the National Center for Health Statistics, lightning kills about 150 Americans a year and injures about 250.

"Lightning is a secondary effect of electrification in a thunderstorm cloud system. The earth normally is charged negatively with respect to the atmosphere. Lightning occurs when the difference between the positive and negative charges becomes great enough to overcome the resistance of the insulating air, and to force a conductive path for current to flow between the two charges.

"Thunder is the crash and rumble associated with lightning, and is caused by explosive expansion of air heated by the stroke. When lightning is close by, the thunder is a sharp, explosive sound. More distant strokes produce the familiar growl and rumble of thunder.

"The distance in miles to a lightning stroke can be estimated by counting the number of seconds between lightning and thunder and dividing by five.

"Lightning comes in many forms. *Streak lightning* is a single or multiple line from cloud to ground. *Forked lightning* shows the conductive channel. *Sheet lightning* is a shapeless flash covering a broad area, often seen in cloud-to-cloud discharges. *Heat lightning* is seen along the horizon during hot weather, and is believed to be the reflection of lightning occurring beyond the horizon. *Ribbon lightning* is streak lightning whose conductive channel is moved by high winds, making successive strokes seem to parallel one another. *Beaded lightning* appears as an interrupted stroke. *Ball lightning* appears as a luminous globe, doughnut shape, or ellipsoid which hisses as it hurtles from cloud to earth, maneuvers at high speeds, rolls along structures, or hangs suspended in the air.

"With all kinds of frightening things like that which can go crashing about, I think you'd better pay attention to these lightning safety rules," Marvin concluded.

He had Ralph's attention:

1 Stay indoors. Don't go out unless absolutely necessary.

2 Stay away from open doors and windows, fireplaces, radiators, stoves, metal pipes, sinks, and plug-in electrical appliances.

3 If no buildings are available, your best protection is a cave, ditch, canyon, or under clumps of trees in open forest glades which are at least head-high.

4 When there is no shelter, avoid the highest object in the area. If only isolated trees are near, your best action is to crouch in the open, twice as far from isolated trees as the trees are high.

5 Avoid hilltops, open spaces, wire fences, metal clotheslines, exposed sheds, and any electrically conductive elevated objects.

6 Stay in the car if traveling. Cars offer great lightning protection since they rest on insulating rubber tires.

7 Get out of the water and off small boats.

8 Stop tractor work, especially when the tractor is pulling metal equipment, and dismount. Tractors and other implements in metallic contact with the ground are often struck by lightning.

9 Don't handle flammable materials in open containers.

10 Don't use metal objects like fishing rods and golf clubs. Golfers wearing cleated shoes are particularly fine lightning rods.

11 Don't work on fences, telephone or power lines, pipelines or structural fabrication.

12 Don't take laundry off the clotheslines.

13 Don't use the phone during a storm, because lightning may strike telephone lines outside.

14 Don't use plug-in electrical equipment like hair dryers, electric toothbrushes, or electric razors during the storm."

"Marvin, I don't have a car or an electric hair dryer or golf shoes. I am but a humble pig."

"Well," said Marvin, "really I like you better without all that. Simplicity is an enchanting quality."

"Thank you," said Ralph, with relief. "What should I do if someone is struck by lightning?"

"People who are struck by lightning receive a severe electrical shock and may be burned," said Marvin, "but they don't carry an electrical charge, so they can be safely handled. A person you may think killed by lightning could be only stunned or unconscious. Often he can be revived by immediate mouth-to-mouth resuscitation, supplemented by manual heart compression. In a group struck by lightning, those who seem dead should be treated first; those who exhibit vital signs will probably recover by themselves, though burns and other wounds may need treatment. Recovery from lightning strikes usually is total except for possible impairment or loss of sight or hearing."

"Tell me, Marvin, now that we've covered the safety rules, do only thunderstorms cause lightning?"

"No, Ralph, thunderclouds are only the most common producers of lightning. Actually, lightning also occurs in snowstorms, sandstorms, and in clouds above erupting volcanoes. It has even been reported to occur in clear air. You've heard of a 'bolt from the blue'?"

"If my memory serves correctly," said Ralph, frowning, "my saintly mother always used to tell me that's what would hit me if I persisted in my surly, rotten ways. I don't think I want to hear about lightning anymore. Why don't you tell me about flash floods?"

Flash Floods

"Ah," said Marvin, "flash floods. Flash floods are masters in the element of surprise, my most favorite dramatic quality. They rise and fall with almost no advance warning, and you must be a sharp piggy not to get caught unawares. Say, for instance, that you are camping in a dry creek bed, and you see a storm in the distance, but the sky overhead is clear."

"I often rest in dry creek beds after rooting for truffles," said Ralph, worriedly.

"Well, you probably shouldn't do that. You see, the sky could be blue above your head, but a storm miles away could swell the creek at a higher point, and you wouldn't know you were in the way of the runoff until you heard the water roaring towards you." Marvin paused. "So you should make it your business to take care of yourself, and to do that you should know these things:

1 You should know what a forecast river height means in terms of your own property.

2 You should know how far your property is above or below anticipated flood levels. If bad weather is expected, or it is annual flood season where you live, you should know before you camp out how far your campsite is above or below waterways near you.

3 You must know, in order to make any sense of 2, above, how this elevation relates to river gauges for which forecasts are prepared.

4 You should know the location of safe areas in case of flooding.

5 Always seek higher ground, staying out of known water paths such as dry creek or river beds.

6 You can get the above information on flood levels and land elevation relative to rivers and creeks from your local city government or from the State ranger."

"Tell me what a real flash flood is like!" said Ralph.

"Well," answered Marvin, "I know of one in 1970 that was the worst in Arizona history. It happened in the mountains of central Arizona on Saturday afternoon and evening of September 5, I believe. It rained more and harder in one day than ever before. Mountain streams and dry washes rose with rushing, violent waters. Twenty-three people died—all away from home. Fourteen of these victims had tried to flee campgrounds in the headwaters area of Tonto Creek. The Weather Service Officer had sent out releases, and had broadcast forecasts to alert people to the likelihood of flash floods over the weekend."

"Then why were so many people killed?" asked Ralph.

"I don't rightly know," said Marvin, "unless they didn't pay attention; but sometimes flash floods can arise within a couple of hours, such as from sudden and intense rainfall over a small area, or due to a dam failure or an ice jam. They are different in this way from your ordinary garden variety flood, which is usually more widespread in scope and may result, for instance, from melting snow in the mountains running off, or from a prolonged, heavy rainfall. You usually have a few days buildup for an ordinary flood, but flash floods arise often in a matter of a very few hours."

"Marvin," said Ralph worshipfully, "I really want to thank you for telling me all this. I feel much more able to cope now if a violent storm should occur."

"You're welcome," answered Marvin. "For your next lesson tomorrow, I'll teach you how helpful it is to get government pamphlets in your lunch."

"I wish you would," sighed Ralph. "They must be good for something besides eating—they don't taste very good at all."