Mammoth

MAMMOTH WINTER HOST AND NATURALIST TOUR PROGRAMS

REFERENCE MANUAL

Mammoth Mountain
June Mountain
Tamarack

Mammoth

June MOUNTAIN

TAMARACK LODGE & RESORT

Host and Naturalist Programs

Goal:

Help create great memories

THE PHILOSOPHY OF INTERPRETATION

The philosophy of interpretation is captured by four elements: communicate, inspire, reveal and experience. Interpretation focuses on how and why to skillfully communicate culture, history and the natural environment. The goal of interpretation is to inspire greater guest understanding and appreciation. Interpretation promotes experiences that reveal the whole picture. The goal of an interpreter is to connect individuals to the whole.

"A nature guide is a naturalist who can guide others to the secrets of nature."

Enos Mills

"Interpretation promotes awareness; awareness promotes understanding; understanding promotes appreciation; appreciation promotes protection."

National Park Service

THE INTERPRETIVE JOURNEY

Interpretation is a guide, leading guests through history to underlying meanings, from tangible to intangible, from sight to insight. Through orientation, information, and education, interpretation facilitates our guests' participation in resource stewardship, helping them understand their relationships to and impacts on those resources—helping them to care, to understand their challenges in participation of recreation and mountain safety.

Interpretation is a process—dynamic, flexible, and goal driven—leading from understanding to appreciation and through appreciation to preservation, the credo of the interpretive traveler. Done well, forests flourish; done poorly, forests perish.

The interpretive journey will follow many tried and beaten paths and pause at many crossroads. Be open to new directions and destinations, remembering that your footsteps shape the history of interpretation and its legacy of enrichment.

Knowledge of the resource is a constant discovery, the compass to new insights and layers of understanding about the mountain as well as the surrounding mountains, rivers, meadows and valleys that we care about. It is knowing the surroundings and how to move around Mammoth, Tamarack and June. It is cultural history in context and not just facts. It is natural history as ecosystem and environment, not just genus and species. It is an adventure into new interpretations of people, time, and place—the courage to face controversy and challenge.

Knowledge of the audience is the realization that no "average" guest exists. Our guests are infinite in their variety, outlooks, values, and opinions. They exist both inside and outside mountain areas. They are not only the repeat guests who love our ski areas, forest and mountains, but they are old and young, national and international. They question and challenge old ideas and priorities and ask

"why" the full dimensions of heritage are not yet explored. They must be respected as independent travelers on this journey of discovery, free to choose the meaning of the resource for themselves, free to determine what paths their stewardship will follow. And, in doing so, our journey will be exquisitely enriched.

Finally, as the guide, you are part of this equation. Knowledge of yourself is essential because interpreters hold the ultimate responsibility and accountability for their own development. Interpretation is love, not lecture. Sensitivity, attitude, teamwork, and constant evaluation are the tools with which interpreters hone and evaluate their readiness to progress, understanding there will be obstacles in the way.

The outcome of the journey is in all our hands. To affect interpretation, we must first affect a memorable change within our guests, moving them to see a kaleidoscope of meanings with critical and wondering eyes. We are the facilitators of connecting people to resources. We are the catalysts for creating interpretive opportunities and outcomes. But interpretation instructs; it does not inflict. We can lead guests to the brink of learning, but the leap of caring and concern must be theirs.

LEARNING CONCEPT

We must understand what motivates our guests to participate in an interpretive program. The main reason for their visit is to have fun while enjoying a number of recreational activities. Taking part in an interpretative program is not the sole reason for their visit. Guests are on vacation and having fun is primary. Consequently, any learning or interpretive activity should be recreational and promote the notion that learning is fun. With this in mind, an interpretive guide should be humorous, involve the guests, keep information understandable, and *always* enthusiastic.

STRUCTURING YOUR INTERPRETATIVE PROGRAM

Introduction

- Introduce yourself and ask others to do the same. Make sure you know how many people are in your group
- Briefly describe the upcoming tour (what you will see, talk about and do), how long it will take and where it will conclude (in most cases, the same place you start from)
- Ask group members what they are most interested in learning about and tailor your presentation to ensure those specific subject areas are covered
- You might begin with a rhetorical question or thought provoking statement
- Communication and learning occur when you have the guests' attention and keep them interested

Bridge

- A bridge connects your introduction to the body of your discussion
- Bridges should answer the guests question, "OK, you have my attention, but what's the purpose and why should I care?"

Body

- The body consists of facts and concepts that give substance to your program
- Create mental images for your guests through metaphors and analogies
- Use guided imagery to transport people to distant times and places, allow your audience to visualize the scene
- Use voice inflection, gestures and pause for moments of reflection
- Repeatedly ask for questions. Encourage discussion

Conclusion

- Summarize your main points
- Close with a quote or dramatic ending for emotional impact
- Thank your guests for coming, ask if they have any more questions, and pass out comment cards. If possible, have guests complete them while you wait (you will also need to distribute pens and pencils) to help ensure we get them back. Otherwise, they can leave them with a Host, the Adventure Center staff or at the front desk of any resort lodging

Mammoth

Winter Host and Naturalist Mammoth Way Service Plan

Mission:

Help create great memories

Strategy:

Provide friendly, accurate information and direction

Service Experience Trail:

Mammoth Mountain Tour Guides – Providing education of guests from either Canyon or Main Lodge on the best conditions, runs and services, as well as history of Mammoth, all as determined by the guests' desires
Eleven53 Host Docents – Accurate information and assistance with Stations and displays in addition to providing general guidance on experiences
USFS volunteer Naturalists – Guides promoting interpretative opportunities on the Mammoth and June Mountains plus Tamarack Cross-Country Ski Area, sharing USFS and Mammoth philosophies

Key Experiences:

Guests' first impression is of a warm, friendly greeting
Accurate information to provide our guests with a lasting impression
Exceed guests' expectations with fun, interactive learning experiences
Hosts and Naturalists lead by example – friendly, neat, clean and safe positive interactions with guests, Managers, Supervisors and other MMSA and USFS employees

Touchpoints

Canyon Lodge meeting area
Main Lodge meeting area
Eleven53 Interpretive Center
Mill/Goldrush meeting area
June Mountain Chalet meeting area
Tamarack Cross-country Ski Center

Service Standards

Professional Appearance Requirements
Timeliness
Warm, Friendly Greeting
Accurate Information
Safety
Tour Implementation
Friendly Closing

Observed MMSA and USFS Naturalist Guide Service Standards

- Professional Appearance Requirement
    1. Host or Forest Service volunteer jackets
    2. Eleven53 Host shirts, when appropriate
    3. Host jacket clean and zipped up at least two-thirds way
    4. Black or khaki pants, worn appropriately
    5. Name tag visible with correct information
    6. Appropriate hair and facial hair requirements, as determined by MMSA for Host guides or USFS Volunteer Naturalist guides
    7. Smoking/Tobacco is not allowed while in uniform

1. Warm, Friendly Greeting
    1. Make eye contact and use a sincere smile
    2. Always provide a consistent, professional, upbeat positive attitude with a welcoming, open gesture
    3. Make the guests have the feeling that we want them here!
    4. Use friendly verbal greeting, "Good morning, how can I help you?" or "Welcome to Mammoth/Tamarack/June"
    5. Observe and actively listen to guests to help determine needs and desires
    6. Confirm you have met the guest's needs and thank them by using time appropriate closing
- Provide Accurate Information and Directions
    1. Ask questions to determine guests' needs and actively listen to responses
    2. Provide information about daily updates on weather, conditions and special events
    3. Provide answers about mountain and area services
    4. Provide accurate directions to different services and opportunities
    5. Know all area trails
    6. Provide trail maps
2. Safety
    1. Always stay hydrated and protected against sun and weather exposure
    2. Check yourself and others during cold temperatures for frostbite or frostnip
    3. When carrying heavy objects use a buddy
    4. Notify Director of unsafe conditions
    5. Advise guests of current weather conditions, including possibilities of lightning in the area
    6. If an you have an injury, contact the Director immediately
- Keep Area Clean
    1. Observe and manage any trash dropped by guests
    2. When observing guests with trash, offer to take it from them
- Friendly Closing
    1. Wish them a good day while enjoying the Mountain and area
    2. Thank the guest for visiting Mammoth
    3. Complete all contact information before leaving at the end of the day

Eleven53 Interpretive Service Station Standards

- Conduct Opening Procedures
    1. Retrieve and turn on touchpads for each computer, matching each correctly
    2. Confirm touchpads have a green light; charge by plugging it into the computer with the USB cord if the light is solid red
    3. Change computers to menu screens
    4. Set up skins, skulls, tracks and scat displays
    5. Set up tree displays with cones and cards
    6. Put water in the rock bowl and set up rocks in the appropriate places
    7. Put out the "Kinetic Sand" with molds
    8. Confirm "Fly Over" touch screens are working and in the full screen mode

- Provide Assistance with Eleven53 Activities

1. Use Docent computer to provide specific, available information
2. Ensure all computer screens have menus available for guests to utilize when there are no guests engaged with the screen
3. Use skins, skulls, scat and track displays, as well as the tree display, to provide tactical opportunities
4. Assist children with "Kinetic Sand" display for making temporary tracks
5. Oversee rock display area, maintaining cleanliness and water level in the bowl
6. Utilize relief maps to provide perspective of Mammoth Mountain's location along the Sierra
7. Offer them the opportunity to complete the Guest Registry, if they have not

- Oversee Interactive Computers
  1. Confirm interactive computers are working and on the menu screen when guest have moved away
  2. Direct guests with navigation
  3. Confirm "Fly Over" computers are functioning, in the full screen view, and provide assistance as needed
- Closing Procedures
  4. Empty water basin and store rocks in cabinet below
  5. Store skins, skulls and tracks in cabinets
  6. Place cones in the appropriate labeled bags before storing in cabinet
  7. Clean up "Kinetic Sand" area and store in skins and skulls cabinet
  8. Confirm all monitors are switched to a slide show and the menu bar is not displayed
  9. Do a final walk through of seating areas to ensure cleanliness
  10. Complete Docent sheet contact information and inventory form, if brochures are needed, before leaving area; return inventory form to office

Mountain Tour Service Standards

- Conduct Tour to Meet Guests' Needs
  1. Place sign at Main Lodge Supersign or Canyon Lodge off the 3rd floor deck no later than 9:15
  2. Arrive at gathering locations no later than 10:00
  3. Greet and recruit for the Mountain Tour
  4. Introduce yourself and request guests' names
  5. Leave start location at 10:15
  6. Evaluate guest skiing/snowboarding abilities while travelling to the Mill
  7. Group guests according to ability level when at the Mill and divide accordingly
  8. Conduct the tour route on intermediate or beginner level runs only
  9. Use wind and weather conditions and group ability to determine route
  10. Speed of tour is dependent on slowest guest
  11. Use safe group handling techniques for moving tour around Mountain
  12. Complete tour by 1:00
  13. Remove tour sign and place in appropriate location at completion of tour
- Provide Accurate Information and Directions
  1. Pre-ski your upper route area shortly after brief morning meeting to determine conditions
  2. Communicate a run conditions report with other Ski Hosts at 10:00
  3. Ask questions to determine guests' interest and incorporate into tour topics
  4. Offer trail maps and refer to detail during tour
  5. Provide accurate information on tour topics
- Tour Safety
  1. Assess your guests' well-being and equipment as appropriate for the tour and conditions
  2. Maximum size of tours with one Host is 7 or 14 with an additional Host
  3. Always stop groups on the sides of runs where they are visible from above and below; never stop below lift lines or downhill of break overs
  4. Stop groups to the side before entering or crossing major trail junctions; decide on strategy ahead of time to get people safely through difficult passages or congested areas

5. Stay to the sides of congested runs wherever possible
6. Ask everyone to stop below the group – never stop at the top of the group, explaining the "domino effect"
7. Be careful not to face people directly into the sun or wind, or with a strong wind blowing directly against their backs; on cold, windy days, constantly watch for any signs of frostbite
8. Count everyone each time you stop to ensure no one is missing; wait for any slower guests to catch up and before starting off again, make sure all guests are adequately rested
9. If you encounter a guest needing assistance, call for help from other Hosts and/or Ski Patrol, following regular on-hill protocol

- Offer Friendly Closing
  1. Give guest tour comment card, asking them to return to another Host or Information Desk
  2. If a guest prefers to leave the tour before it is over, direct them back to their desired location, either by showing them on the map, pointing out a visible path or directing them to the Supersigns at McCoy Station or below the top of Rollercoaster lift

Mammoth Mountain Naturalist Service Standards

- Conduct Tour to Meet Guests' Needs
  1. Place sign between the Mill and the bottom of Goldrush no later than 10:00
  2. Arrive at gathering locations no later than 10:15
  3. Greet and recruit for the Naturalist Tour
  4. Introduce yourself and request guests' names
  5. Ask guests to self-evaluate their ability level to help confirm they are intermediate level or better
  6. Meet the Host guides arriving from Main and Canyon with the guests they gathered
  7. Divide group according to interest
  8. Leave start location by 10:45
  9. Conduct the tour route on intermediate or beginner level runs only
  10. If guests are strong intermediate or advanced level and conditions are appropriate, skiing to the fumarole via Christmas Bowl is acceptable
  11. Use wind and weather conditions and group ability to determine route
  12. Speed of tour is dependent on slowest guest
  13. Use safe group handling techniques for moving tour around Mountain
  14. After completing tour, returning to the Mill, unless agreed upon arrangements have been made, go to Eleven53 for at least one hour; communicate with your guests when you will arrive, before or after you have a lunch
  15. Remove tour sign and place in appropriate location at completion of tour
- Provide Accurate Information and Directions
  1. Pre-ski your upper route area shortly after brief morning meeting to determine conditions
  2. Ask Ski Hosts guiding Mountain tours for additional conditions report
  3. Ask questions to determine guests' interest and incorporate into tour topics
  4. Offer trail maps and refer to detail during tour
  5. Provide accurate information on tour topics
  6. Complete tour report via hard copy or website form as soon as possible after completion of tour
- Focal topics
  1. Geology topics should always include the caldera, steam vents, including the fumarole and chain of volcanoes
  2. Trees – Mountain Hemlock, White and Red Fir, Lodgepole, Jeffrey, Western White and Whitebark pines
  3. Animals – Coyote, Chickaree, Clark's Nutcracker, Chickadee, Raven, Steller's Jay
  4. History – Mining, Mammoth Mountain development and Tourism
- Tour Safety
  1. Assess your guests' well-being and equipment as appropriate for the tour and conditions

2. Maximum size of tours by yourself is 7 or 14 with a Host tailing
3. Always stop groups on the sides of runs where they are visible from above and below; never stop below lift lines or downhill of break overs
4. Stop groups to the side before entering or crossing major trail junctions; decide on strategy ahead of time to get people safely through difficult passages or congested areas
5. Stay to the sides of congested runs wherever possible
6. Ask everyone to stop below the group – never stop at the top of the group, explaining the "domino effect"
7. Be careful not to face people directly into the sun or wind, or with a strong wind blowing directly against their backs; on cold, windy days, constantly watch for any signs of frostbite
8. Count everyone each time you stop to ensure no one is missing; wait for any slower guests to catch up and before starting off again, make sure all guests are adequately rested
9. If you encounter a guest needing assistance, call for help from other Hosts and/or Ski Patrol, following regular on-hill protocol

- Offer Friendly Closing
  1. Give guest tour comment card, asking them to return to another Host or Information Desk
  2. If a guest prefers to leave the tour before it is over, direct them back to their desired location, either by showing them on the map, pointing out a visible path or directing them to the Supersigns at McCoy Station or below the top of Rollercoaster lift

June Mountain Naturalist Service Standards

- Conduct Tour to Meet Guests' Needs
  1. Place banners at the top of J1, the bottom of J7 and the sign at the meeting location at the June Chalet patio area no later than 10:00
  2. Arrive at gathering locations no later than 10:15 and 12:45
  3. Greet and recruit for the Naturalist Tour
  4. Introduce yourself and request guests' names
  5. Ask guests to self-evaluate their ability level to help confirm they are intermediate level or better
  6. Leave start location by 10:35 or 1:05
  7. Conduct the tour route on intermediate or beginner level runs only
  8. Use wind and weather conditions and group ability to determine route
  9. Speed of tour is dependent on slowest guest
  10. Use safe group handling techniques for moving tour around Mountain
  11. Remove tour banners and sign and place in appropriate location at completion of tour
- Provide Accurate Information and Directions
  1. Pre-ski your upper route area shortly after arrival to determine conditions
  2. Ask questions to determine guests' interest and incorporate into tour topics
  3. Offer trail maps and refer to detail during tour
  4. Provide accurate information on tour topics
  5. Complete tour report via hard copy or website form as soon as possible after completion of tour
- Focal topics
  1. Geology topics should always include the caldera, chain of volcanoes and surrounding topography
  2. Trees – Lodgepole and Whitebark pines
  3. Animals – Coyote, Chickaree, Clark's Nutcracker, Chickadee, Raven, Steller's Jay
  4. History – Mining, Mono Lake, June Mountain development and Tourism
- Tour Safety
  1. Assess your guests' well-being and equipment as appropriate for the tour and conditions
  2. Maximum size of tours by is 7
  3. Always stop groups on the sides of runs where they are visible from above and below; never stop below lift lines or downhill of break overs
  4. Stop groups to the side before entering or crossing major trail junctions; decide on strategy ahead of time to get people safely through difficult passages or congested areas

5. Stay to the sides of congested runs wherever possible
6. Ask everyone to stop below the group – never stop at the top of the group, explaining the "domino effect"
7. Be careful not to face people directly into the sun or wind, or with a strong wind blowing directly against their backs; on cold, windy days, constantly watch for any signs of frostbite
8. Count everyone each time you stop to ensure no one is missing; wait for any slower guests to catch up and before starting off again, make sure all guests are adequately rested
9. If you encounter a guest needing assistance, call for help from other Hosts and/or Ski Patrol, following regular on-hill protocol

- Offer Friendly Closing
  1. Give guest tour comment card, asking them to return to the Information Desk
  2. If a guest prefers to leave the tour before it is over, direct them back to their desired location

Tamarack Snowshoe and Cross Country Ski Naturalist Service Standards

- Conduct Tour to Meet Guests' Needs
  1. Ensure banner is place outside the Ski Center no later than 10:00
  2. Arrive at gathering locations no later than 10:15
  3. Greet and recruit for the Naturalist Tour
  4. Introduce yourself and request guests' names
  5. Ask guests to self-evaluate either their snowshoe or cross-country ski ability level and stamina to help confirm the terrain you should offer
  6. Leave start location by 10:35
  7. Conduct the cross-country ski tour route on intermediate or beginner level runs only
  8. Do not stop guests on ski tracks; never allow snowshoe guests to walk on tracks
  9. Use wind and weather conditions and group ability to determine route
  10. Speed of tour is dependent on slowest guest
  11. Use safe group handling techniques for moving tour around area
  12. Always direct guests to the next stopping point, making sure it is always visible
  13. Remove tour banners and sign and place in appropriate location at completion of tour
- Provide Accurate Information and Directions
  1. Pre-ski or snowshoe portions of your route area shortly after arrival to determine conditions
  2. Ask questions to determine guests' interest and incorporate into tour topics
  3. Offer trail maps and refer to detail during tour
  4. Provide accurate information on tour topics
  5. Complete tour report via hard copy or website form as soon as possible after completion of tour
- Focal Topics
  1. Geology topics should always include the caldera, chain of volcanoes and surrounding topography
  2. Trees – Lodgepole and Whitebark pines
  3. Animals – Coyote, Chickaree, Clark's Nutcracker, Chickadee, Raven, Steller's Jay
  4. History – Mining, Mono Lake, June Mountain development and Tourism
- Tour Safety
  1. Assess your guests' well-being and equipment as appropriate for the tour and conditions
  2. Maximum size of tours by is 20 for snowshoe or 10 for cross-country ski
  3. Always stop groups in areas with maximum visibility
  4. Stop groups to the side before entering or crossing trail junctions; decide on strategy ahead of time to get people safely through difficult passages or congested areas
  5. Ask everyone on skis to stop below the group – never stop at the top of the group, explaining the "domino effect"
  6. Be careful not to face people directly into the sun or wind, or with a strong wind blowing directly against their backs; on cold, windy days, constantly watch for any signs of frostbite

7. Count everyone each time you stop to ensure no one is missing; wait for any slower guests to catch up and before starting off again, make sure all guests are adequately rested
8. If you encounter an injured guest during your tour, do not move them. Cross their skis above them. If they are not seriously injured, note their exact location and ski with your group to the Center or to find a Host. If you have a cell phone, call the Ski Center at 760.934.2442 ext. 8 for assistance and wait with the injured person if they are alone until assistance arrives.
9. If someone is injured in your group, do not move them. Place crossed skis above them. Note your exact location. If you have a cell phone, **immediately call the Ski Center at** 760.934.2442 ext. 8 for assistance (a laminated card with emergency numbers will be in your pack**).** If you do not have a cell phone, choose your strongest skier(s) and ask them to ski to the Ski Center or to find a Host. Make sure they know exactly where they are going and where the injured person is located. Stay with the injured person until assistance arrives. Make sure to complete Accident Injury Report ASAP.

- Offer Friendly Closing
  1. Give guest tour comment card, asking them to return to the Information Desk
  2. If a guest prefers to leave the tour before it is over, direct them back to their desired location

MAMMOTH MOUNTAIN INFORMATION

HISTORY

Main Points

- Gold mining, in the late 1870s, brought settlers to the Mammoth area, where one of the original claims was named Mammoth in an effort to interest investors
- Dave McCoy received the first USFS permit to install and manage all terrain on Mammoth Mountain's in 1953, installing and opening Chair 1 for Thanksgiving 1955
- Intrawest Corporation purchased a majority share of Mammoth in 1996
- Starwood Capital bought controlling interest from Dave McCoy in December 2006
- Mammoth Mountain is a 3,500-acre ski resort.

Once known as "Pumice Mountain," Mammoth Mountain and the surrounding area was named after the Mammoth Mine operation, originally located above Old Mammoth, in the 1870s. The enterprising miners chose the name to convey an image of fabulous wealth in an attempt to boost the perceived value of their claim and attract investors. The name "Mammoth" signified the hope of a large gold vein. However, only a small amount of gold was discovered and the mine went bankrupt a few years later after a couple of exceptionally harsh winters. The name stuck and this area has been known as "Mammoth" ever since.

Dave McCoy developed Mammoth Mountain Ski Area after World War II. Driven by his passion for winter sports, Dave identified the mountain as a perfect location for skiing and built the first rope tow in 1947 where Chair 1 (Broadway Express) now sits, utilizing a yearly special use permit issued by the US Forest Service. Hans Georg developed lifts on the west side where Chair 15 (Eagle Express) now runs. In 1953, Dave was issued the first sole long term, 25 year permit from the USFS to develop the area into a European style resort. From 1955 until 1985, 26 chairlifts, Gondola 1 and 2 and several surface lifts were installed. Following their installation, many upgrades and modernization efforts continue, and with Mammoth's dependable snowfall year after year, its popularity is stable.

Dave, who turned 100 years in August 2015, sold his interest in the corporation in 2006 to Starwood Capital for an outstanding $365 million. Previously, in 1996, shares were sold to Intrawest Corporation, providing extra capital to develop additional amenities. When Starwood purchased their shares, Intrawest and a small number of other shareholders remained involved in Mammoth, allowing continuity with how Mammoth Mountain is managed, a goal Dave held when selling. Included in Mammoth's success were the addition of June Mountain Ski Area, purchased in 1986, and Bear Mountain Resort, comprised of Bear Mountain Ski Area and Snow Summit Ski Area, purchased in 2014.

GEOLOGY

Main Points

- Mammoth is a dormant ("sleeping") cumulo-volcano that sits on the southwest rim of the Long Valley Caldera

- The most recent eruption in the region occurred approximately 250 years ago in the Mono Lake area
- The Caldera was formed approximately 760,000 years ago by a cataclysmic volcanic eruption
- Minor earthquakes are common in the Mammoth Lakes and Owens Valley area
- Carbon dioxide (CO_2) seeping up from deep within the earth along the edge of the Caldera has caused trees to die along Horseshoe Lake and in some places on Mammoth Mountain
- There are four main types of volcanic rock found in the area: granite, rhyolite, obsidian and pumice.

Millions of years of volcanic and glacier activity created the beauty and dramatic scenery of the Mammoth Lakes region. Mammoth Mountain is a "cumulo-volcano," meaning it was built by many successive volcanic eruptions, starting about 100,000 years ago. The last eruption was approximately 50,000 years ago. 25 eruptions, made up of an accumulation of eruptive lava, ash, and tephra (airborne ash and dust), are known to have formed the separate and distinct cones that created the Mountain[1].

Mammoth is located on the south-western rim of the Long Valley Caldera, which was formed about 760,000 years ago by a cataclysmic volcanic eruption thought to be more than 2,000 times greater than the 1980 Mount St. Helens eruption in Washington. Approximately 150 cubic miles of magma exploded from four miles beneath the earth's surface, creating a caldera or "sink" in the earth. The Caldera measures approximately 10 miles wide by 20 miles long, extending from Crowley Lake to Mammoth Mountain, to Glass Creek Dome on the northwest and to Glass Mountain on the northeast. Activity before and after the main eruption helped to shape the surrounding area. The Glass Mountains and areas north were formed from eruptions 2 million to 800,000 years ago and contributed to the formation of the magma chamber that exploded. After the eruption and collapse of the Caldera, further eruptions between 730,000 and 650,000 years ago formed the Resurgent Dome southwest of Hot Creek, known for its surprising recent growth of more than 28" during the 1980s. With the unrest experienced in the 80s, the geologic history and our knowledge of the magma chamber relatively close to the surface, the USGS installed multiple tools to monitor and measure all the activity in the area, including the Resurgent Dome, Mammoth Mountain Fumaroles and along the volcanic chain.

Mammoth Mountain's formation preceded the Inyo / Mono volcanic chain that runs from Red Cones in the southeast all the way to Mono Lake and includes the Inyo and Mono Craters, Obsidian Dome, Wilson Butte, along with several other eruptive domes. These volcanoes have erupted often over the past 40,000 years. Over the last 5,000 years, an eruption has occurred every 250 to 750 years somewhere along this chain. The most recent eruptions in the area occurred around 250 years ago, forming Paoha Island in Mono Lake.[2] Currently, Mammoth Mountain is dormant ("sleeping") and monitored closely by the United States Geological Survey (USGS) for ongoing volcanic activity.

Minor earthquakes, not necessarily related to movement of the magma underground but instead to the fault systems throughout the west, are common in the Mammoth Lakes area. In fact, numerous earthquakes often occur on a daily basis, although too small to be felt but detected by sensitive

[1] Dr. Wes Hildreth, USGS Volcanologist and lead research scientist for Mammoth Mountain
[2] Dr. David Hill, USGS Seismologist and lead research scientist for Mammoth Lakes' area

instruments.[3] After several earthquakes in 1989, many trees began to die around Horseshoe Lake in the Lakes Basin area. Scientists discovered carbon dioxide (CO_2) seeping up from deep within the earth. Tree roots need oxygen to survive; the increased CO_2 displaces oxygen, eventually suffocating trees. They theorized the 1989 earthquakes caused fissures or cracks to form, allowing gas to rise. Further analysis has determined that all areas lie along the edge of the Caldera where it is butting against the Sierra Range. Rocks from the Sierra and those from the Caldera differ, creating a weak seam.[4] The main tree-kill area is along Horseshoe Lake, but smaller less significant areas can be found on Mammoth Mountain by Chair 12. Wherever these fissures occur, CO_2 accumulates in depressions or holes, under snow banks, and in other low-lying, poorly ventilated areas where it is potentially dangerous to humans and animals.[5]

"Fumaroles," or steam vents, also illustrate the volcanic origin of Mammoth Mountain. A great example can be seen or smelled (a distinct sulfur or rotten egg odor) at the bottom of China Bowl off Face Lift Express (Chair 3). Other fumaroles are sometimes found along the top of Mammoth Mountain, above the Paranoids. Additionally, warm spots in the soil can sometimes cause snow to melt. These release no gas but instead have soil temperatures above freezing even after significant snowfall has cooled the surrounding area.

Magma still occupies the area beneath the caldera and heats underground water. This heat is harnessed by three local geothermal plants at one local site capable of producing 40 megawatts of electricity per hour.[6]

The Ice Age began in the Owens Valley and Mono Basin approximately 2 million years ago. The Sherwin Glacier carved out canyons, hillsides, and exposed several granite outcroppings such as Mammoth Crest and Balloon Dome. The Town of Mammoth Lakes is located on a glacier "moraine" (glacial depositions). These moraines were created as the glaciers expanded and pushed earth in front of them and to the side. Currently, the oldest recognizable glacial deposit is McGee Till, located on the south rim of the Long Valley Caldera on McGee Mountain.[7] Several lake basins in the area are examples of glacial cirques, half open steep sided hollows at the head of a valley or on a mountainside, formed by glacial erosion,[8] including the Mammoth Lakes Basin. All the lakes in the basin, except Horseshoe, are deeper depressions carved by the glaciers. Horseshoe Lake formed as a result of a volcanic eruption after the glaciers disappeared

General Rock Types of the Eastern Sierra:[9]

1. Sedimentary rock: Formed at or near the earth's surface at relatively low temperatures and pressures and usually deposited by water, wind or ice.
   Examples: limestone and sandstone
2. Metamorphic rock: Sedimentary or igneous rock that has been transformed into another rock type deep below the surface of the earth by heat and pressure.
   Examples: marble and slate

[3] Dr. David Hill, USGS
[4] Dr. Wes Hildreth, USGS
[5] USGS Fact Sheet "CO2 Gas Killing Trees at Mammoth"
[6] Bob Sullivan, Mammoth Pacific Geothermal Plant
[7] Roy Bailey, 1987, Geologic Map of the Long Valley Caldera, Mono/Inyo Craters Volcanic Chain and Vicinity, Eastern California.
[8] Oxford Dictionary
[9] http://www.science.ubc.ca/~geol202/petrology/rock.html "Sedimentary, Metamorphic and Igneous Rocks"

3. Igneous rock: Molten material (magma) that cools deep within the earth and is usually exposed by glacial activity.
   Examples: granite and rhyolite
4. Volcanic rock: Molten material (magma) ejected from deep within the earth, cooling on the surface of the earth.
   Examples: obsidian and pumice

There are four main types of magmatic rock found in this area: Granite, rhyolite, obsidian and pumice. Granite is formed by molten rock cooling very slowly underground, allowing large crystals to form within its composition. Rhyolite is rich in silicon, potassium and sodium and is typically finer-grained because it cools quicker than granite. Obsidian is rhyolite lava that cools extremely fast above ground, creating a glassy appearance that is most often black. Pumice is lava infused with gases and air bubbles, similar to foam on top of soda. Once cooled, it is very light and often floats on water.

General Location Map of the Long Valley Area

MAMMOTH'S TOP TEN GEOLOGICAL QUESTIONS

(Answers provided by USGS seismologist, Dr. David Hill)

1. **Where is the volcano?**
   A. There is no single volcano. The area of most recent activity (in the last 40,000 years) is along the Inyo / Mono volcanic chain, which runs from just north of Mono Lake to the Red Cones, south of Mammoth Mountain.

2. **What is the possibility of a major eruption?**
   A. Small to moderate eruptions have occurred every few hundred years within the above-mentioned region. It is possible that geological unrest could escalate into an eruption, however geologists think the chance of any major activity in the area is small.

3. **If we had an eruption similar to the most recent one in Mono Lake (about 250 years ago), what would the damage be to the Town of Mammoth Lakes?**
   A. The eruption at Mono Lake was small and had little to no impact on the Mammoth Lakes area. An eruption of its size today might leave a few inches of ash and pumice to clean up in the Town of Mammoth Lakes.

5. **What would be the likely size of an eruption?**
   A. In the last 4,000 years, eruptions have been small to moderate in size. Given this history, future eruptions will likely be the same size.

5. **Would a local eruption be similar to the Mount St. Helens eruption?**
   A. It is very unlikely. Most of the damage caused by the Mount St. Helens was due to a lateral eruption that blew the entire north side of the mountain away. Eruptions in the Long Valley area in the last 4,000 years have been vertical eruptions from isolated vents.

6. **Is Mammoth an active volcano?**
   A. No. It is a dormant ("sleeping") volcano.

7. **Is there a higher risk of damage from geological activity in this area than elsewhere in California?**
   A. No. In fact, other areas of California face a somewhat higher risk because of many active faults and the relative high frequency of moderate to large earthquakes.

8. **Are small earthquakes considered normal activity for this region?**
   A. Small earthquakes are common in this area and do not present an immediate threat.

9. **What is the largest recorded earthquake in the Mammoth area?**
   A. In May of 1980, there were four magnitude 6 earthquakes.

10. **Is the area monitored for geologic activity?**
    A. The area surrounding the Long Valley Caldera is one of the closest monitored regions in the world. The onset of any volcanic activity can be predicted with fair reliability, and in the unlikely event of an eruption, the community would be warned of the potential danger.

PROMINATE PEAKS AND LANDMARKS

Main Points

- Mount Ritter (13,157 feet)
- Banner Peak (12,945 feet)
- The Minarets are a collection of 17 jagged peaks; Clyde Minaret is the tallest at 12,281 feet
- The San Joaquin Ridge is the dividing line between the eastern and western Sierra Nevada mountain range
- The mountains surrounding Convict Lake are dated at 500million years and are almost the oldest in the Sierra Nevada, only eclipsed by a small group of mountains outside Big Pine
- Boundary Peak (13,143 feet) is Nevada's highest peak, seen to the northeast
- White Mountain Peak (14,264 feet) is the third highest peak in California and fifth highest in the contiguous United States

Ritter Range

The Ritter Range is located west of Mammoth Mountain in the Ansel Adams Wilderness. Approximately 100 million years old, the range is composed of numerous jagged pinnacles and peaks formed out of basalt and shaped by ice, wind, rockslides and earthquakes. Mount Ritter, the most prominent of the peaks at 13,157 feet high, was first attempted in 1864 by an American team who named it after Karl Ritter, founder of Modern Comparative Geography. John Muir was the first person to successfully summit its peak in 1872.

Immediately to the north of Mount Ritter is Banner Peak, which stands 12,945 feet high. Banner Peak was first climbed in 1883 by a USGS topographer who named it after the cloud "banners" streaming across the summit.

Immediately to the south of Ritter and Banner stand 17 jagged peaks known as "The Minarets." These peaks were named as a group due to their resemblance to the towers on Mosques (Minaret means "pillar" or "tower" in Arabic). Individual peaks have since been named by those who first climbed them. Clyde Minaret is the tallest at 12,281 feet.

Yosemite National Park is located behind and to the north of the Ritter Range. It can be accessed through Donohue Pass on the John Muir trail, a 31-mile hike to Tuolumne Meadows from the trailhead at Agnew Meadows.

San Joaquin Ridge

Located west of Mammoth Mountain, the San Joaquin Ridge is the dividing line between the eastern and western Sierra Nevada mountain range. Watershed on the western slope supports the Central Valley (agriculture and residents) and eventually reaches the Pacific Ocean via the San Joaquin River. The watershed on the east side drains into the California Aqueduct, supplying southern California.

Balloon Dome

Balloon Dome is located south of Mammoth Mountain along the San Joaquin River Canyon in the John Muir Wilderness. Millions of years ago, glaciers carved out this granite dome by eroding the surrounding softer rock and debris. Very similar in appearance, it is often mistakenly identified as Half Dome in Yosemite.

Mammoth Crest and Crystal Crag
Rising above the Lakes Basin, southeast of Mammoth Mountain, is Mammoth Crest and Crystal Crag. Both are composed mainly of granite and are examples of the incredible influence glaciers had on shaping the Mammoth region.

Mammoth Rock
This pillar of marble, located along the base of the Sherwin Range, overlooking Old Mammoth, withstood glacier erosion as the weaker surrounding rock was carved away.

Inyo Craters
The Inyo Craters are three north-south aligned phreatic explosion craters on the summit and south flank of Deer Mountain. These phreatic explosions or "steam eruptions" produced numerous craters in the surrounding area. These types of eruptions occurred when water and heated volcanic rock interacted to produce a violent eruption of steam and pulverized rock. The two craters located on the south flank of Deer Mountain are referred to as the north crater and south crater. These craters measure approximately 600 feet across, north crater is approximately 100 feet deep while south crater is more than 200 feet deep. Both north and south craters contain small lakes, the summit crater on Deer Mountain is dry. Detailed studies of the pumice layers around these craters and Deer Mountain have shown that the steam eruptions in this area occurred in sequence from north to south within days, possibly hours of each other in 1351.

Deer Mountain
This 8,786-foot rhyolite dome was formed approximately 100,000 years ago as residual magma was expelled from the chamber beneath the caldera. The most recent activity was in the form of steam eruptions, which took place about 500 years ago along with the Inyo Craters and created a small crater on top of Deer Mountain.

Lookout Mountain
Located east of the Scenic Loop/Highway 395 intersection, this volcano formed approximately 150,000 years after the collapse of the Long Valley Caldera. It is mainly composed of silica-rich rhyolite and stands at 8,352 feet tall. Currently, a fire lookout station occupies its summit, operated by the U.S. Forest Service.

Bald Mountain
Located along the east rim of the Long Valley Caldera and northeast of Lookout Mountain, this 9,046 foot high volcano formed before the Long Valley eruption, approximately 1-2 million years ago. There is a picnic area and warming hut for visitors at the top, which can be accessed via a Forest Service dirt road.

White Mountains
The White Mountains are located east of Mammoth along the California/ Nevada border. White Mountain Peak (14,264 feet) is the third highest peak in California and home to the highest High Altitude Research Center in North America. Boundary Peak (13,143 feet), Nevada's highest peak, is located at the northern tip of the White Mountain Range.

SNOW

Main Points

- Mammoth Mountain receives an annual average of 30 feet of snow.
- Mammoth has the ability to cover 46 trails with manmade snow.

Mammoth Mountain receives an annual average of 30 feet of snow, an unusually high amount for the dry Eastern Sierra. Normally, storms drop the majority of their precipitation (snow or rain) on the western slope of the Sierra Nevada mountain range. However, Mammoth Mountain is located in a gap in the range, allowing storms to pass through and drop an enormous amount of snow. Due to its unique topography, the ski area is usually able to open by Thanksgiving with natural snow. Snowmaking has allowed Mammoth to open on a scheduled date in early November, usually right before or on Veteran's Day. Earlier natural snow fall can allow for an earlier opening. Currently, Mammoth Mountain has the ability to cover 46 trails with manmade snow.[10] The water used for snowmaking is collected from runoff and pumped into two snowmaking ponds. The larger reservoir, located next to McCoy Station, has the ability to hold up to 26 million gallons of water.

Snow fences, built near wind-prone areas, help control snow deposition by causing it to accumulate downwind behind the fences. This ensures ample coverage and distribution at the top of the mountain and in other windy areas. Grooming helps maintain snow on the runs as well. Areas which have been compacted through grooming can keep snow consistent much longer than areas that accumulate snow and are not managed.

JUNE MOUNTAIN INFORMATION

HISTORY

Main Points

- The June Lake region was originally developed as a recreational fishing resort area
- Bud Hayward opened June Mountain in 1961
- Mammoth Mountain purchased June Mountain in 1986

Avid fishermen have visited the June Lake Loop area – previously known as Horseshoe Canyon – since the early 1900s in search of large "trophy fish."[11] Travelers came from hundreds of miles to discover the area's tranquil and untouched beauty. With the advent of the automobile came the demand for paved roads, making the area more accessible to all recreation enthusiasts.

In 1961, Bud Hayward opened June Mountain Ski Area with Chair 1 and a poma lift on the face of June Mountain. The new ski area brought year-round recreation to June Lake and the economy grew as fisherman and skiers flocked to the area. By 1970, two more lifts were added. Local school children learned to ski at June as part of their physical education program, a program that continues today.

Mammoth Mountain purchased June Mountain in 1986. Since then, many upgrades have been added, maintaining June Mountain's popularity as a family-friendly ski resort.

[10] Mammoth Mountain webpage
[11] Betty Bean, 1997, *Horseshoe Canyon*

GEOLOGY

Main Points

- June Lake Loop was formed approximately one million years ago
- "Balanced Rock" is a famous June Lake landmark

The June Lake Loop was formed approximately one million years ago by the Rush Creek Glacier, known to be the largest glacier in the Mono Lake Basin at a size of nearly 24 square miles.[12] Carving out June Mountain as it cut through the canyon, the immense glacial force that shaped the landscape is demonstrated by the unique "Balanced Rock" located next to the June Lake Fire Station at the entrance to town. Left behind as the glacier retreated, this huge boulder has remained precariously balanced upon its granite perch for the last million years.

SNOW

Main Points

- June Mountain receives an annual average of 20 feet of snow
- June's ski season usually runs from mid-December, typically the second weekend, to mid-April, depending upon snowfall amounts

June Mountain receives an average of 20 feet of snow annually. Similar to Mammoth Mountain, this amount is unusually high for the Eastern Sierra. Normally, storms drop the majority of their snow on the western slope of the Sierra Nevada mountain range. However, like Mammoth, the topography surrounding June Mountain allows storms to reach the mountain and drop large amounts of snow. Unlike Mammoth, however, June Mountain has limited snowmaking capabilities and is mainly dependent upon nature for its coverage. This leads to a ski season that usually runs from December to April. Many guests unfamiliar with June Mountain's "upside down" layout, where the easier runs are found at mid-mountain, close to the June Chalet, and the steepest at the bottom and at a lower elevation, are underwhelmed when arriving in the June parking lot. After riding Chair 1 to the Chalet, many happy new guests exclaim over their experiences, especially following new "powder" storms, where untouched runs can be found throughout the day and even in following days.

June Mountain has been greatly affected by the Pine Bark Beetle, decimating many of the trees in the area. The current drought has stressed the overcrowded trees on the slopes, causing them to become much more susceptible to attack. Mammoth Mountain and the US Forest Service on working together, using grant money, to remove a large percentage of the potentially highly flammable trees.

June's future appeared to be in jeopardy just 3 short years ago. Due to the age of the resort, the current maintenance schedule and the lack of snow the last few years, as well as challenging snowfall throughout the state of California, June has not received an overwhelming number of guests. To entice more families to the beautiful rolling terrain, a concerted effort has been made to create the right experience. Anyone visiting the Resort on a weekend can witness the efforts. Unfortunately, the most intimidating part for many families is the ride to and from the Chalet on J1. This chair, a two passenger fixed grip, center pole chair, is unfamiliar and cold for the ride up.

[12] Betty Bean, 1997, *Horseshoe Canyon*

It's heart stopping to some for the ride down at the end of the day, although the view is spectacular. Mammoth Resorts understands the need to improve this experience but snowmaking is key to investing in the change. Without a guaranteed snow experience, it's difficult to justify the expense of building a multi-million dollar Gondola. In the effort to pursue the idea, hydrologist and drillers have been hired to find a good underground water source. Pulling water from the surrounding lakes is not an option. As of 2015, no significant source has been found, but continued efforts are in place. There is a strong commitment to make every effort possible to succeed at making June the place it can become.

TAMARACK RESORT INFORMATION

HISTORY

Main Points

- Tamarack Lodge was originally built in 1924.
- Mammoth Mountain purchased Tamarack Lodge and Resort in 1998.
- Tamarack Cross Country Ski Center offers 42 kilometers of groomed tracks.

Tamarack Lodge was originally built in 1924 by the Foy family of Los Angeles, who were immortalized by Bob Hope in the movie *The Seven Little Foys.* The rustic lodge, overlooking the beautiful Twin Lakes, was used by the family to host gatherings of socialites from the entertainment world.

In 1927, Tamarack was purchased by the Austin family from Pasadena, who added cabins and developed the property into a summertime fishing resort and wintertime ski destination. Fishermen and families visited from far and wide, leading to a colrful folklore built around the winter skiers and basin caretakers. With no open roads above Mammoth in the winter, all transportation was via dog sled, snowshoes or skis. Winters were long and the caretakers led isolated and adventuresome lives. Pictures from this era – the thirties and forties – can be viewed throughout the lodge and on the walls of the Lakefront Restaurant.

In the 1950s and 60s, Tamarack was owned by the Stanford family. In the 60s, the family began keeping the lodge open year-round, leading to the commercial development of skiing in the Lakes Basin. In the mid-70s, the lodge changed ownership again, gaining renown as a center for Nordic skiing (at that time, a relatively new sport to America), known more commonly today as cross-country skiing.

David and Carol Watson bought Tamarack in 1986. Through vision and perseverance, they enjoyed a very productive decade. Tamarack Lodge and Resort became one of the west's premier outdoor vacation destinations while the Lakefront Restaurant secured a spot in the upper echelon of California's best restaurants.

Tamarack Lodge and Resort, including the Lakefront Restaurant and Cross-Country Ski Center, was purchased by Mammoth Mountain in 1998. The lodge and adjacent cabins are undergoing extensive restoration and 'modernization' while preserving their unique mountain retreat ambience. The Ski Center has grown dramatically – pushed by a surge in cross-country skiing as a healthy and fun alternative to downhill skiing – now offering 42 kilometers of groomed trails winding their way through the scenic Lakes Basin.

REGIONAL INFORMATION

EARLIEST INHABITANTS

Main Points

- Northern Paiutes have inhabited the Eastern Sierra for many centuries.
- Paiutes are related to the Shoshoni, Bannock and other Great Basin native Americans.

Northern Paiutes have inhabited the Eastern Sierra for hundreds of years. No one knows exactly how long. It is believed their ancestors migrated from central Asia twenty or thirty thousand years ago and fanned out across America, with some descendants eventually locating in the Eastern Sierra. Related by language and culture to the Shoshoni, Bannock and other Great Basin peoples, "Paiute" was the name early white explorers bestowed upon them. Many still live here today, continuing to hand down traditions as time continues to change the landscape of their homeland.

LAKES BASIN

Main Points

- "Mammoth Lakes" name from the Lakes Basin
- Formed by glaciation
- Number of lakes

MONO LAKE

Main Points

- Mono Lake is one of the oldest lakes in North America.
- It is a "terminal" lake, meaning it has no outlets.
- Mono Lake supports a very simple food chain.
- In 1994, a bill was passed to protect Mono Lake's delicate ecosystem.

One of the oldest lakes in North America, Mono Lake is located 15 miles north of the June Lake Junction on Highway 395, just past Lee Vining.[13] It is at least 760,000 years old and is a "terminal lake," meaning it has no outlet. This causes salts and minerals – deposited into the lake by surrounding springs and tributaries – to build up and concentrate, making the lake 3 times saltier than the ocean. This condition leads to the formation of "tufa." Tufa is made up of calcium carbonate formed when fresh water, rich in calcium, combines with lake water, rich in carbonates.

Because of the high salt concentration, Mono Lake can only support a very simple food chain consisting of brine shrimp and alkali flies, once an important food source for the Paiutes and still critical to thousands of nesting and migratory birds, including the second largest colony of California Gulls in the United States.

Mono Lake has two islands, Negit and Paoha, part of the Inyo / Mono volcanic chain. Paoha Island was formed about 250 years ago by the most recent volcanic eruption.

[13] http://www.monolake.org

In 1941, the Los Angeles Department of Water and Power (DWP) completed an aqueduct that diverted water from four of the six streams that feed Mono Lake. This caused the lake to shrink to half its original size, while its salinity doubled. The extreme increase in salinity affected the productivity of several species. In 1994, the State Water Resources Control Board passed a bill to protect Mono Lake. The bill limits the amount of water diverted from Mono Lake's tributaries in an effort to raise the lake level. This bill has effectively helped Mono Lake's delicate ecosystem and increased hope for a stable environment.

The Mono Lake Visitor Center in Lee Vining is an excellent source of additional information about this unique, world famous lake.

THE LOST CEMENT MINE

Like many historic ghost mines of yesterday, the Lost Cement Mine has a cloudy history with many different versions.[14] Local legend describes an incredible mine where lumps of pure gold were "cemented'' together in a rich gold vein, hence the name. Two German brothers claimed they discovered this mine in 1857 while crossing the Sierra Nevada near the headwaters of the Owens River. They found so much gold that they argued over whether or not it was real. Consequently, only one brother took a sample and drew a map to its location. He later confirmed that it was gold, but before he could return to the mine he became terminally ill. Knowing he would be unable to return to the claim, he paid his physician, Dr. Randall, with the gold and map to its location.

Dr. Randall shared this knowledge with a few friends and together went searching for the mine. Whether or not the gold vein was ever found remains a mystery and point of local debate. Today, many still search for its existence in hopes of "striking it rich." A historic plaque detailing this debatable history can be viewed at the rest stop on Highway 395, just north of the Mammoth Lakes Scenic Loop junction.

[14] Wright, 1984, *The Lost Cement Mine*

WILDLIFE OF THE EASTERN SIERRA

The Eastern Sierra is home to an abundance of wildlife. Some of the more common residents include the following animals and birds:[15]

BLACK BEAR

The black bear is the only native bear remaining in the Sierra Nevada mountain range. Despite their name, they are often brown or cinnamon in color, frequently with a white blaze on their chest. They are good swimmers and tree climbers who can run up to 30 miles an hour, but they normally move in a slow, lumbering fashion. Mature adults usually weigh from 200 to 300 pounds, however some males weigh as much as 600 pounds. Nocturnal by nature (active mainly at night), black bears are mainly vegetarian, but also eat insects, grubs, fish, small mammals and dead animals. Bears do not truly hibernate. Unless food is abundant, however, they will sleep through winter in hollow, downed trees or caves.

To help keep these powerful animals safe and prevent unwanted encounters often resulting in damaged property; all food should be carefully stored and kept out of sight. All observations of black bears should be done at a safe distance and *never* come between a mother and her cubs.

COYOTE

The coyote is a member of the canine family like dogs, foxes and wolves. Similar in appearance to a long-legged dog with a shaggy brown coat, their Latin name, Canis latrans, means "barking dogs." They have a special yip or howl that is different from dogs and wolves, but like wolves, they often "sing" together. Coyotes usually weigh between 20 and 35 pounds and can run up to 40 miles an hour and leap 14 feet. They are also great swimmers.

[15] Alfred A. Knopf, Inc., 1997, *National Audubon Society, Field Guide to North American Mammals* and Roger Tory Peterson, 1990, *Western Birds*

Coyotes are normally scavengers, but often hunt birds, rodents and other small creatures, including domestic cats and small dogs. As social animals, they often work in packs, hunting for prey as large as deer. With keen eyesight and sharp hearing and sense of smell, coyotes adapt easily to changes in their environment. It is important to keep food, trash and pets out of reach of coyotes to help protect these wild animals.

Mountain Lion

Mountain lions are the most widely distributed wild cat in North and South America. These predators lead solitary lives and are very territorial. Mountain lions will hunt day and night in undisturbed areas, but only at night in populated areas to avoid human contact. Deer make up the majority of their diet and mountain lions will migrate with deer herds to insure their food source. They also eat coyotes, raccoons, mice, marmots, and hares. They are good climbers and excellent jumpers, able to leap more than 20 feet. Mountain lions will normally avoid humans, but they can become a danger and contact should never be attempted with these wild predator

Mule Deer

Mule deer are very common in the Mammoth area during the spring and summer. They migrate in the winter to warmer locations to avoid heavy snow. “Black-Tail Deer,” found only on the Pacific Coast, have a blackish or brown tail as opposed to other mule deer with a black-tipped white tail. The mule deer is named after its large ears, which they move almost constantly like a mule. Mule deer mainly feed upon herbaceous plants and grasses in the summer and twigs of juniper and sage in the winter.

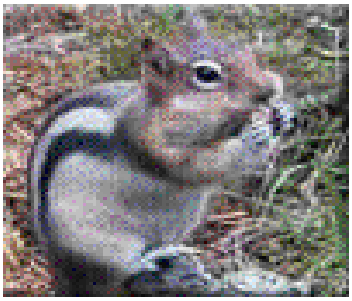
Long-tailed Weasel

The Long-tailed weasel has a brown fur on its back and a yellow belly. Its tail is brown with a black tip and equal in size to its head and body length. This fierce predator is diurnal (active mainly during the day) and mainly feeds upon voles, chipmunks, birds and occasionally insects. It uses dens abandoned by other small mammals, such as chipmunks and squirrels, to provide shelter and raise its young. Within the den, weasels build nests from the hair of their prey.

Long-tailed weasels have a variety of sounds or vocalizations, including squealing or screeching when excited and purring when content.

Pine Marten

The pine marten is brownish in color with a pale brown belly, orange throat patch and a long bushy tail. They are active in the early morning, late afternoon, and at night, traversing a home range of 5 to 15 square miles. Spending most of their time foraging for food, their diet includes rodents, insects, and conifer seeds. Pine martens have few enemies other than humans. They are easy to catch and their desirable pelt has caused them to become extinct in many areas. Lumber industries have also threatened their habitat and reduced their population. Today, the pine marten is protected and making a comeback in many areas.



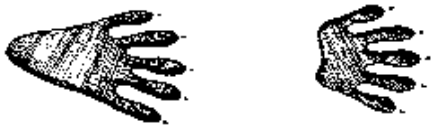
Golden-mantled Ground Squirrel

The Golden-mantled ground squirrel has a gray to brownish back with a coppery red head and shoulders, forming a golden mantle. They have two white stripes bordered by black strips on their

back. There are no stripes on the face, a characteristic distinguishing them from their close relative, the chipmunk. The Golden-mantled ground squirrel has well-developed cheek pouches, allowing it to carry large amount of seeds and nuts to its den for storage. They hibernate in the winter and will occasionally awake to feed, but the majority of their food storage is for feeding in early spring. Their diet consists of piñon pine nuts, seeds, fruits, subterranean fungi and coniferous seeds.

Raccoon

The mischievous raccoon can be easily identified by the mask of black fur around their eyes and black ringed tail on an otherwise grayish-brown body. They will eat a variety of foods, including fish, amphibians, insects, birds, mice, nuts, berries and vegetation. Chiefly nocturnal (active mainly at night), raccoons are commonly sighted in suburban areas forging for an easy meal. They are highly intelligent and make a variety of vocalizations, such as cries, whistles, growls and screeches.



White-tailed Jackrabbit

The white-tailed jackrabbbit (often mistaken for the Tahoe snowshoe hare) has a buffy grey coat in the summer and an almost completely white coat (except for the tips ears) in the winter. They are very solitary animals and only socialize during the mating season. Mainly nocturnal, they hide most of the day, camoflaugeing themsleves in the snowy winter landscape. In the winter, they mainly feed on twigs, buds and dried vegetation. In the summer, they mainly eat green vegetation.

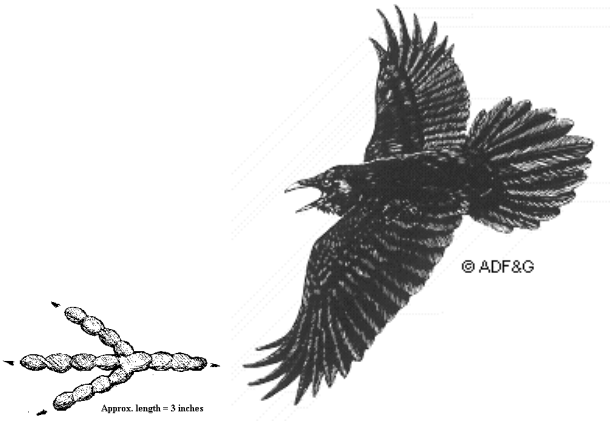
Steller's Jay

Slightly larger than a robin, Steller's jays are seen year-round in the Sierra Nevada mountain range, identified by a blackish crest on top of their head and a deep blue body, wings, and tail. They are intelligent, bold birds possessing a variety of calls, the most common one being harsh and raucous. However, near their own nests, built of twigs and mud, Steller's jays are quiet and secretive. Their main foods are nuts, grains and insects. Being very resourceful, they also frequent bird feeders and campgrounds, where they know picnic scraps are plentiful.

Common Raven

One of the most often seen birds in the Mammoth Lakes area is the common raven. The raven is the largest species of songbird and largest all-black bird in the world. They are excellent fliers and sometimes seen soaring at great heights.

Ravens are very intelligent and have an unmistakable deep, resonant "kaw" vocalization and often sound like someone playing a wood block instrument. Generally predators, these opportunistic feeders can be seen feeding on any free meal.



Mountain Chickadee

The mountain chickadee is a small bird that lives year-round in the Eastern Sierra. Smaller than sparrows, mountain chickadees have a black head and neck, gray back and tail, and a lighter colored underside. They are very active, curious and quick moving birds that are heard more often than seen with their distinctive "chick-a-dee" call. They are also referred to as the "cheeseburger bird" due to their spring/summer call that sounds similar to "cheese-bur-ger." Living in forested areas, they can be seen alone or in loose flocks eating insects, fruit and seeds. They are relatively tame and are sometimes seen hanging upside down from tree branches foraging for food. Both parents raise their clutch of 6 to 8 eggs in a nest that is 4 to ten feet off the ground in a tree cavity or nest box.

Clark's Nutcracker


The Clark's nutcracker shares a symbiotic relationship with the whitebark pine, meaning that they both benefit from the association. Whitebark pine cones do not open and the seeds do not have wings like many other pines. The Clark's nutcracker is able to remove the seeds from the cones, storing them for later consumption. Studies have shown that a single bird can cache up to 98,000 seeds in one season. In heavy seed years, the nutcracker retrieves only about half of its seeds. The remaining seeds were not forgotten; simply more than the nutcracker needed. These leftover seeds may germinate in the spring, depending on environmental conditions. Therefore, the whitebark pine provides food and the nutcracker provides an opportunity for the tree to reproduce. Both of their future success depends on one another and their special relationship. (See handout "The Mutual Aid Society: Clark's Nutcracker And Whitebark Pine" for more information.)

TREES OF THE EASTERN SIERRA

Among the many species of trees growing throughout the Eastern Sierra, the following native conifers (cone-bearing evergreens), deciduous trees and shrubs can be found around the Mammoth and June Mountain region:[16]

Lodgepole Pine (Pinus contorta ssp. murrayana)

Lodgepole Pines grow in moist areas and reproduce as early as six years of age. They are found growing at elevations between 6,000 and 9,000 feet, often living among Red and White Firs, Jeffrey Pine, and Quaking Aspen. In drier climates, they can be found at elevations up to 11,000 feet living with Whitebark Pine, Western White Pine and Mountain Hemlock. Lodgepole are very common on Mammoth Mountain and are also known erroneously as Tamarack Pines, hence the name "Tamarack Lodge." Their trunks are usually relatively straight and taper very little, making them popular for building cabins and tipis, hence, their name.

Lodgepole are the only pine that bear needles in groups of two. The needles are short (about 2 inches), fairly stiff and prickly. Periodically the needles can become infested with the larvae of "the Pine Needle Miner." This insect lays its eggs in the needle and "mines" or eats through, sometimes digesting half a dozen needles before it turns into a moth. However, Lodgepole can tolerate a high degree of infestation without developing many side effects. The bark is grayish, thin and "oatmeal" in appearance. The trees bear many small cones, similar to golf balls in shape and size. In the Sierra, Lodgepole cones open with or without the help of fire, producing winged seeds carried by wind. Chickarees, chipmunks, crossbills and nutcrackers feed on the seeds.

Western White Pine (Pinus monticola)

The Western White Pine is a relatively tall pine (100-150 feet tall) found at elevations between 7,500 and 10,500 feet where the snowpack is deep and the growing season short. They can be found growing with Lodgepole, Jeffrey, Mountain Hemlock and Red Fir, however, they do not

[16] *Tree Identification*
http://treelink.org/whattree/

tolerant deep shade and seedlings will not mature under a dense stand. Western White Pine can be identified by 6 to 10 inch-long narrow, slightly curved cones hanging in bunches from the tips of branches resembling bananas. In the fall, the cones drip pitch profusely (making them a poor choice to park cars under), and appear to sparkle in the sunshine. They only bear a few cones, though, usually every 3 to 4 years.

Also commonly known as "Silver Pine," Western White Pine have slender, soft blue-green needles 2 to 4 inches long growing in bundles of five. They have straight trunks with layered tiers of horizontal branches, except those in the upper crown, which arch upwards. The bark is light gray on young trees, maturing to square or rectangular brownish-orange sections.

Whitebark Pine (Pinus albicaulis)

Whitebark Pines are small conifers (3 to 35 feet) found at high elevations between 9,000 and 11,000 feet, growing with Red Fir, Lodgepole and Western White Pine. Harsh winds, cold temperatures and short growing seasons combine to give this tree a shrubby, twisted shape referred to as "Krummholz," a German word for wind-shaped trees meaning "crooked wood."

Whitebark Pine grow very slowly, taking as long as 500 years to grow 7 inches in diameter. Their bark is chalky white or silver if wind-whipped. The yellowish-green needles are 1.5 to 3.5 inches long, growing in bundles of five. Purplish cones grow up to 3 inches long on the ends of upswept branches, maturing in late August or early September of their second year. In early fall, they dry out and turn brown, but do not open to release the seeds like most cones do. However, the cone scales lack tough fibers allowing birds, most notably the Clark's Nutcracker, to step in and service the trees by breaking the cones open with their strong beaks. The Nutcracker then extracts the seeds, storing up to 100 in a sublingual pouch below its tongue, increasing its own weight by up to one fourth. They then cache the seeds underground to eat at a later time. Nutcrackers have amazing memories, but not all seeds are recovered. This allows the remaining seeds to germinate and produce new trees. Surprisingly, this is the only known method of Whitebark Pine reproduction. Because most caches contain many seeds, many Whitebark Pine grow close together in clumps. Whitebark Pine also have multi-stems arising from a single root system, resembling many small individual trees growing close together.

Jeffrey Pine (Pinus jeffreyi)

 The world's largest Jeffrey Pine forest – 200 square miles in size – is located in the Joaquin Ridge. Found at 5500 to 9,000 feet, Jeffrey Pine are very tall trees with blue-green needles up to 6 inches long in bundles of three. It can live up to 500 years. The large, beehive shaped cones are 5 to 10 inches long, and have slender, incurved prickles that point downward. The cones open in the fall, and allow the one-inch winged seeds to spread on the breeze. The Jeffrey Pine is shade intolerant and resistant to fire. It is sensitive to ozone pollution and has suffered significant damage in the mountains of southern California. The bark of mature trees is cracked into irregular reddish brown plates like large jigsaw pieces with a distinct vanilla or butterscotch odor. The Paiute Indians of the area had a food source from the Jeffrey Pine. Caterpillars of the Pandora Moth eat Jeffrey Pine needles, and in turn, the Paiutes feasted upon the yummy caterpillars, which were called "Peagge." The caterpillars were roasted and stored for later use.

Jeffrey Pine also produces a chemical discovered in 1867 by a turpentine distiller. A chemical called "abietin" was isolated in the Jeffrey Pine pitch. Abietin contains 96% normal heptane, a hydrocarbon also found in petroleum, and it was discovered that a cheaper, purer heptane could be produced from Jeffrey Pine rather than other methods. The heptane derived was used as a permanent yardstick for grading fuels under a system called "octane rating." This became an important step in the evolution of combustion engines. Later in the 1970s, it was found that several Jeffrey and Ponderosa Pines in the San Bernardino Mountains were dying from automobile exhaust.

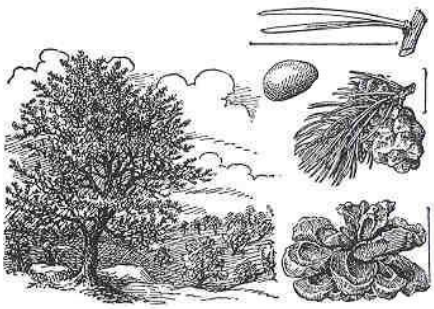
Pinyon Pine (Pinus monophylla)

Pinyon Pine are small gray conifers that grow on dry mountain slopes at elevations of 5,000 to 7,500 feet. They are small, shrubby trees, standing 16 to 30 feet tall at maturity. Their bark is brown to gray and becomes furrowed with age. Their thick scaled cones are 2 to 3 inches long, oval, and very resinous.

Pinyon Pine are commonly found along the Eastern Sierra in the Owens Valley and Mono Basin. They are also common throughout the desert ranges of Nevada. Sometimes, Pinyon are the only tree growing in arid mountain ranges and deserts as they can survive with less than 10 inches of rain annually.

Many botanists are surprised that the Pinyon is considered a pine, since pines are distinguished from other conifers by their needles that form in clusters of 2 to 5. Pinyon is the only exception. Its cluster is wrapped in a thin sheath like other pines, but contains only one sharp pointed needle, which is actually composed of five needles fused together.

For thousands of years, Pinyon Pine nuts have been an important food source for Native Americans of the Eastern Sierra and the southwest. The nuts are also important to squirrels and birds. Since Pinyon form a squat, heart shape, Native Americans could easily knock the cones down with poles. Gum or resin from the pinyon was collected and used by the Indians to help soothe a sore throat or as a cure for rheumatism, tuberculosis. Settlers made fencing and timbers from this tree.



Pinyon pine (*Pinus edulis*)

Red Fir, a.k.a. "Silvertip" (Abies magnifica)

California Red Fir gets its name from the deep red inner bark. This large tree grows slowly, but when mature, can rise to 150 to 200 feet. The tallest firs are usually hit by lightning, leaving damaged crowns and snag tops. They most often grow in pure stands, but can also be found among other high elevation conifers—Jeffrey, Lodgepole, Western White Pine, Whitebark Pine and Mountain Hemlock. The needles are short, thick and blunt, and square enough to be rolled between the fingers, up to 1¼ inches in length, with a hockey-stick curve at the base. Young bark is smooth and white, becoming furrowed with age and turning dark brown on the outside and red on the inside. The tops of older trees often snap off in high winds due to the species' susceptibility to core rot. Fir cones, seldom found on the ground, usually disintegrate on the trees in the fall, leaving center stems standing upright on the branch tops, resembling Christmas tree candles. They release large winged seeds throughout the fall and winter. Barrel shaped cones are 6-8 inches long and purplish-brown. New growth at the tips of red fir branches is silver in color, also giving them the name "silver-tip." Needles leave flat, round scars on the branchlet when they fall. All firs are shade tolerant.

White Fir (Abies concolor)

White Fir grows in rocky mountain soils between 3,000 and 8,000 feet. Sometimes found at 10,000 feet. They are difficult to distinguish from Red Firs, but not as common on the eastern slope of the Sierra. They have single needles usually more than one inch long and blunt at the tip with a half twist at the base instead of the hockey-stick curve found on red fir needles. Additionally, new growth at the tips of branches is bright green in color instead of silver and the inner bark is tan, as opposed to the red. White Fir does not produce cones each year—heavy crops appear between 3 and 9 years. The cones are somewhat smaller than Red Fir; about 3-5 inches. Tree growth is slow during the first 30 years. Afterwards, it becomes rapid. The seeds it produces are too bitter for humans, but many songbirds and mammals eat them.

Mountain Hemlock (Tsuga mertensiana)

Known as John Muir's favorite tree, Mountain Hemlocks most often grow above 9,500 feet and are easily identified by their bent, drooping tops. They are found in areas with the heaviest snowfall, and the drooping tops shed snow to avoid crowns from breaking. Hemlocks grow slowly (a tree with a 20 inch diameter may be 250 years old), but they produce an abundant crop of seeds. During productive years, cones can be so numerous that they weigh down the branches. The cones are 2 to 3 inches long and their scales bend back towards the base of the cone after opening. The single round needles are up to .75 inches long arranged on branches in unique spur shoots, giving the limbs a soft, bushy appearance. Some of these trees live for more than 800 years. Branches are sometimes pinned to the ground by snowpack, creating thickets that provide winter cover for birds and mammals.

Western Juniper (Juniperus occidentalis)

A member of the Cypress family, the Western Juniper is a gnarled, burly little tree that can be found growing at altitudes of 6,500 to 10,500 feet in dry rocky locations throughout the Sierra and Great Basin region. Not easily confused with other trees, the Juniper's distinctive features include minute scale-like leaves on bushy boughs, blue berry-like cones, and squatty, gnarled features. They frequently survive storms and sun for 1,000 years, and their bulky bark-stripped and weather-polished trunks and tattered crowns look their age. The roots of this hardy tree extend through crevices in the rock, anchoring it to sites where lack of soil, extreme exposure to blizzards, and summer drought do not allow other conifers to survive.

Birds and other animals play an important role in the germination and distribution of the Western Juniper. The blue berry-like fruits mature in the fall and cling to the trees all winter, providing an excellent food supply for mountain wildlife. Experiments have shown that many juniper seeds will not germinate unless they pass through the alimentary tract of a bird or mammal. Another scientist has estimated that bird dissemination of juniper seeds is responsible for up two-thirds of the total seeding in natural stands. Humans also have made use of Juniper "berries" as the flavoring for gin. Since many Juniper bear male and female cones on separate trees, some trees never produce berries.

Reddish in color and pleasantly aromatic, Juniper heartwood is exceedingly durable. Used for fence posts on the western range, California Indians also made arrow shafts from the tough, heavy wood and fastened the feathers with the resin.

Quaking Aspen (Populus tremuloides)

Quaking Aspen are one of the most colorful trees in the high Sierra. In the summer, the leaves are bright green on top and silver underneath. In the fall before winter, they are a brilliant yellow, gold, orange, and sometimes red. Although a small grove of Aspen can produce millions of tiny seeds, few of them are viable and new Aspen produced from seeds are considered a rarity in much of the mountain west. Instead, Aspen reproduce through new shoots from stumps of existing root systems, especially after a fire. The groves are called "clones" because each tree arises from a common root system and seedlings expand by sprouting in available habitat. Some Aspen groves will be golden in the fall, others yellowish; thus *the clones enter winter dormancy at different times.* Quaking Aspen can be distinguished from Cottonwoods by several characteristics: Smooth, whitish-gray bark on mature aspens contrasts with the rough bark on cottonwoods and most other species; Aspen's small buds are shiny, but not filled with resin like the larger Cottonwood buds; Aspen leaves are almost round except for their pointed tip and because the leaves grow on long stalks which are flattened in the cross section, they quiver in the slightest breeze. Quaking Aspen has one of the largest distributions of any tree in North America. They will grow throughout the Sierra between 6,000 and 10,000 feet in moist meadows or in rock piles, especially at the bases of cliffs where there is plenty of ground water. Intolerant of shade and competition from conifers, Aspen do not inhabit the dense forest. The buds, bark and shoots are a favorite food of beaver and deer; domestic stock like it, also. Aspen usually live only 50 to 60 years and grow up to a foot in diameter and 50 feet high.

Mountain Alder (Alnus tenuifolia)

Mountain Alder are deciduous plants that grow as a tall shrub in wet areas between 4500 and 8500 feet. Its roots help hold banks together along streams and its shade provides a habitat for ferns and wildflowers, which like moist environments. Alders grows between 20 and 50 feet high. The trunk is smooth and gray or sometimes reddish brown. The dark green, coarse leaves are oval to nearly round and from 2 to 3.5 inches long. The leaves begin to drop with the frosts, frequently without turning brown. Alders are easy to recognize in the winter because of the clusters of three to seven small, pine cone like structures at the ends of some of the smaller branches. Each "cone" is about .4 to .75 inches long, with hard, woody bracts enclosing winged fruits before they are shed. The seeds are favorites of Grosbeaks, Finches and Pine Siskins. The branches of Alder have elliptical, reddish brown buds. If one looks carefully, near the base of the dormant staminate catkins, there will be several smaller, immature female cones. It will also be evident that the empty cones from last summer were produced on branches developed during the previous summer. These are located at the base of the most recent growth, and sometimes the cones that formed two summers ago may still be seen.

Alder flowers are wind pollinated and one of the first to bloom in the spring. The dangling male catkin (named for its resemblance to a cat's tail) produces a four part flower with two to four stamens. Catkins and woody cones can remain on the tree for up to a year. Alder is a nitrogen fixer,

but is not a member of the pea family. Specialized nodules in Alder roots host bacteria that traps free nitrogen from the air and absorbs it into a living protoplasm. Eventually, this nitrogen becomes available to the host plant (Alder). If the bacteria occurs separate from the root nodules, it is unable to capture nitrogen. Thus, the bacteria gets nourishment from the host plant (Alder), while the host in turn benefits from the nitrogen captured by the parasite bacteria on its roots. This kind of mutual dependency is known as "symbiosis." Therefore, Alders help add nitrogen to the soil. Pure Alder stands typically have 23 percent more nitrogen in the soil. The presence of Alders is a sign of permanent running water, more so than that of Cottonwoods or Willows because Alders will not grow in seasonal streams or rivers.

Deer sometimes make use of Alder during severe winters. It has been utilized by tanners, and an extract made from the leaves or bark has been used as a tonic and as an ingredient in bitters. Some alders have been used for making charcoal. Altogether there are about thirty five species of alder distributed throughout North America. Alders belong to the birch family and other common representatives are the hazelnut and hormbeam. the genus name Salix is an old Latin name for willow which is thought to be derived from two celtic words—sal, meaning near, and lis, meaning water.

Willow (Salix sp.)

There are about a dozen Willows found in the Sierra. It can be a challenge to the trained botanist to identify the different types. Willow is found near streams or moist areas and is the best for making baskets and other useful items. It has slender, straight, brightly colored yellow to reddish twigs, simple leaves and narrow clusters of catkins or "pussy willows," which bloom before the leaves appear in the spring. Willow seeds germinate fast—they grow within the first 24 hours of being shed. Depending on the type of Willow and its location, it can grow from 20 to 45 feet tall, and from 3,000 feet to 10,000 feet elevation in the Sierra Mountains.

Willows produce a compound known as salicin which is chemically closely related to acetylsalicylic acid, better known as aspirin. Salicin may account for the many uses by the Indians of the Great Basin. They used Willows to treat toothache, stomachache, diarrhea, dysentery, venereal disease and dandruff.

ANCIENT BRISTLECONE PINE FOREST

High atop the dry mountains of the Great Basin are the oldest living organisms on earth, the Bristlecone Pine (*Pinus longaeva* and *Pinus aristata*). Found in six of the western states, these ancient trees can be seen in the Ancient Bristlecone Pine Forest, a 58,000-acre reserve in the White Mountains of eastern California's Inyo National Forest.[1]

The average age of these trees is 1,000 years old, but they often live more than 2,000 years. The oldest known living tree in the world has been discovered recently in the Bristlecone Pine Forest and is more than 5,065 years old. Prior to its discovery in 2013, the "Methuselah tree" in the same grove was celebrated as the oldest, but it has proven to be 118 years younger. The discovery of an older tree helps to insure to scientist that an even older specimens might be found in the future.

Bristlecone Pines have developed several strategies for survival and have the ability to live in very harsh climates where no other plants or trees can survive, allowing them to flourish for thousands of years in a competition-free environment. Their needles can live 20 to 30 years, providing ample photosynthetic energy to the trees even during years of severe stress. Bristlecone are not susceptible to invasions from bacteria, fungus or insects due to their dense, highly resinous wood, and even the oldest trees can still produce cones with viable seeds. They can also remain standing for hundreds of years after death. The tree will fall only after its supporting roots have decayed or been weakened by erosion. The older Bristlecone live in exposed areas with considerable space between each tree. This distance protects the trees from a fire spreading throughout the forest, jumping from tree to tree.

These amazing trees will continue to live for hundreds of years if their environment is protected and they are given the respect they deserve. Make sure to suggest a visit to the Ancient Bristlecone Pine Forest to your guests so they can see these ancient beauties up close.

About the Forest Service

[1] Irwin, 1991, *California's Eastern Sierra, A Visitor's Guide*

The United States Forest Service is a federal agency in the Department of Agriculture that manages public lands in national forests and grasslands. The Forest Service is also the largest forestry research organization in the world, and provides technical and financial assistance to State and private forestry agencies. Gifford Pinchot, the first Chief of the Forest Service, summed up the mission of the Forest Service---"To provide the greatest amount of good for the greatest amount of people in the long run."

Congress established the Forest Service in 1905 to provide quality water and timber for the nation's benefit. Over the years, the public has expanded the list of what they want from national forests and grasslands. Congress responded by directing the Forest Service to manage national forests for additional "multiple uses and benefits" and for the sustained yield of renewable resources such as water, forage, wildlife, wood, and recreation. Multiple use means managing resources under the best combination of uses to benefit the American people while ensuring the productivity of the land and protecting the quality of the environment.

National forests are America's great outdoors. They encompass 191 million acres of land, which is an area equivalent to the size of Texas. National forests provide opportunities for recreation in open spaces and natural environments. People enjoy a wide variety of activities on national forests, including backpacking, hiking, off highway vehicle (OHV) trails, mountain biking, and fishing.

The job of Forest Service managers is to help the public enjoy the forest, while conserving the environment for generations to come. Some activities are compatible, and some are not. As a concerned citizen, you play a key role in helping managers balance all of these uses.

The Forest Service carries out its mission, "Caring for the Land and Serving the People," through five main activities:

* Protection and management of natural resources on National Forest System lands.

* Research on all aspects of forestry, rangeland management, and forest resource utilization.

* Community assistance and cooperation with State and local governments, forest industries, and private landowners to help protect and manage non-Federal forest and associated range and watershed lands to improve conditions in rural areas.

* Achieving and supporting an effective workforce that reflects the full range of diversity of the American people.

* International assistance in formulating policy and coordinating U.S. support for the protection and sound management of the world's forest resources.

History of the Inyo National Forest

In 1893, the federal government created the Sierra Timber Reserve to protect timber, grass and water resources on the slopes of the Sierra Nevada mountain range. The reserve originally contained more than four million acres spanning both sides of the Sierra Nevada, and further additions brought the total to over six million. The Federal Department of Agriculture later took over control, naming it the Sierra National Forest. Its vast size made the forest difficult to administer, however, so President Theodore Roosevelt carved out the Inyo National Forest in 1907. In 1908, the Mono National Forest was also created, stretching across Alpine and Mono counties in California, and Douglas, Lyon and Mineral counties in Nevada. In 1942, it was disbanded, however, and the Mono County district was absorbed by the Inyo National Forest, while the rest became part of the Toiyabe National Forest, headquartered at Sparks, Nevada.

Today the Inyo National Forest is the second largest forest in California. It is divided into four Ranger Districts with main headquarters in Bishop and district offices in Lone Pine, Mammoth Lakes, and Lee Vining. Covering approximately 1.9 million acres in the eastern Sierra, it stretches from 18 miles south of Owens Lake north 175 miles to Conway Summit, just north of Mono Lake. Its vast range covers the John Muir, Ansel Adams, Hoover, Boundary Peak and Golden Trout wilderness areas, including the headwaters of the Middle Fork of the San Joaquin River on the west slope of the Sierra, the Glass Mountains along the eastern edge of Long Valley, the White Mountains along the California-Nevada border, and the northern half of the Inyo Mountains.

Covering such a broad range, the Inyo Forest spans altitudes from 4,000 to over 14,000 feet with corresponding vegetation communities of semi-arid desert to alpine. While very high in altitude, the White Mountains on the California-Nevada border are in a zone of low rainfall with tree species that survive under extreme conditions, including juniper, pinyon and bristlecone pine.

The Inyo Forest includes many notable formations, including the southernmost glacier in the United States—Palisade Glacier; the oldest known living organism—a 4,700+ year-old bristlecone pine; the world's largest jeffrey pine forest; the highest mountain in the continental United States—Mt. Whitney; one of the world's highest roads—The White Mountain road serving the Ancient Bristlecone Pine Forest; and the world's largest sage brush in the White Mountains.

Today, water is one of the most important resources in the area, with over 1.1 million acre feet sold annually at an estimated value of around $250 million. A large amount is diverted to supply about 70 percent of the needs of the city of Los Angeles. Cattle ranching and mining were also important uses of the forest historically. Today, the Inyo remains active as a summer range and over 3,000 mining claims still exist. The Inyo National Forest also sells up to 3 million board feet of lumber annually for personal use and commercial fuelwood, down from 7 million in recent years. The Forest is also an active volcanic region with some of its power harnessed by the Long Valley Geothermal Plant.

Resources for Additional Information:

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- **Mammoth History**

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- **June Lake History**

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- **Geology**

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Geologic Map of the Long Valley Caldera, Mono/Inyo Craters Volcanic Chain, and Vicinity, Eastern California, Roy A. Bailey, 1987

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Discovering Sierra Trees, Stephen F. Arno, 1973, Yosemite Association

Shrubs of the Great Basin, A Natural History
Hugh N. Mozingo, 1987, University of Nevada Press

- **Useful WEB Sites**:

Long Valley Caldera Volcanic Observatory:
http://lvo.wr.usgs.gov/

Eruptions from the Inyo chain about 600 Years ago:
http://lvo.wr.usgs.gov/InyoEruption/index.html

USGS Volcano Hazards Program:
http://volcanoes.usgs.gov/

MMSA Environmental Programs (Nature & History):
http://www.mammothmountain.com/CorporateHome/Environment/NatureandHistory

Useful USGS PDF Documents (Downloadable Handouts):

Boiling Water at Hot Creek:
http://pubs.usgs.gov/fs/2007/3045/fs2007-3045.pdf

Scientific Drilling in Long Valley:
http://pubs.usgs.gov/fs/1998/fs077-98/fs077-98.pdf

CO2 Gas Killing Trees at Mammoth:
http://pubs.usgs.gov/fs/fs172-96/fs172-96.pdf

Living with a Restless Caldera:
http://pubs.usgs.gov/fs/fs108-96/fs108-96.pdf

Future Eruptions, What's Likely:
http://pubs.usgs.gov/fs/fs073-97/fs073-97.pdf

In partnership with the Inyo National Forest