Lesson Overview: Students will view a slide show that displays historical and recent photos of conditions in lower and upper montane Sierra Nevada forests. They will consider how current conditions differ from those of the past. A professional wildland manager will visit the classroom to discuss and answer student questions about historical and current forest conditions and the challenges of forest management.

Lesson Goal: Students will understand that forest management influences current and future conditions, and that in many locations, forests are very different from their historical conditions.

Objectives:
- Students will analyze photographs from “Fire in Sierra Nevada forests: A photographic interpretation of ecological change since 1849” by George E. Gruell to see how forests have changed over the past 150 years.
- Students will prepare questions to ask the fire manager.
- Students will listen to a guest presentation, then write a reflection on how montane forests of the Sierra Nevada have changed and how those changes affect forest management.

Teacher Background: In order for this activity to work, you must contact someone with expert knowledge of local fire management and/or ecology (a fire manager, fire ecologist, district ranger etc.) and schedule a time for him or her to come to your classroom (or video conference with you) and speak with your students. The expert should be prepared to discuss or answer questions about current conditions of local forests and how they have changed from historical conditions, how the forest’s relationship with fire has changed, and how local forests are managed today.

Materials and Preparation:
- Download H19_A Photographic Interpretation.pptx. This slide show consists of 6 sets of photos – one from the 1800s or early 1900s, the other from the 1990s. In each set, the
first photo is the early one, the second photo is the later one, and the third photo shows
them together.

- Obtain Post-It Notes (10/student)
- Find and schedule a guest speaker (fire manager, fire ecologist, district ranger, etc.) to
talk with your class about the current conditions of local forests, how they may differ
from historical conditions, and how that affects land management decisions. Be sure to
explain the goals of the presentation; if your guest wants to talk about something else
(and you want that information), adjust the procedure below so the students will
prepare appropriately.

Procedure:

1. Explain: To complete our study of wildland fire, we’re going to have a professional land
manager come to our class and tell us about his/her work, his/her concerns about fire in
wildland ecosystems, and how he/she addresses these challenges. We’ll use this class
session to prepare for our guest.

2. Write the following questions on the board in three columns, so students can put Post-It
notes under each topic.

   “What did Sierra Nevada forests and woodlands look like before and during the
   early stages of Euro-American settlement?”

   “How has the vegetation changed since Euro-Americans settled in the region?”

   “What human activities and natural processes have influenced vegetation and landscape change?”

3. Hand out 10 Post-It notes to each student.

4. Go through H19_A Photographic Interpretation.pptx, (slides are shown below). The
presentation contains 6 sets of photos, 3 photos in each set. For each photo set:

   - When you get to the 3rd photo (with both of the previous ones on it), have students use
     3 Post-It notes to write a response to each question on the board. Remind them to write
     only one observation per Post-It.
   - Have them stick their Post-Its on the board under the respective questions.
   - Review the Post-Its and discuss the three questions on the board for that set of photos.
   - Move the Post-Its off to the side so the board is uncluttered for the next set of photos.

5. After you have completed the slide show, ask: What human influences have led to current
conditions in the Sierra Nevada? Euro-American settlement, decline in Native American
populations, forest management/harvesting, development of transportation corridors, fire
management, human influences on climate change, invasive species, the Industrial Revolution….

6. What natural processes have led to these conditions? Succession, fire, native insects and pathogens, climate change...

7. Ask/discuss: Under current conditions, what challenges do plants, animals, and humans face? Possible answers:
   - Fire exclusion has resulted in forests that are denser than they were historically. These dense forests are favored by shade-tolerant species such as white fir and Douglas-fir at the expense of shade-intolerant species such as ponderosa pine, Jeffrey pine, and sugar pine. Species that thrive in open, sunny forests are challenged to find suitable habitat in dense, shady forests.
   - Under hot, dry, and windy conditions, dense forests with a lot of surface, ladder, and crown fuels are more likely to burn intensely and result in large areas of stand-replacing fire. This kind of fire often threatens homes and communities in and near the forests. Large areas of stand-replacing fire make it difficult for many native plants and animals to survive and establish in those areas.

8. Ask: What challenges and considerations do forest and fire managers have to consider when managing today's forest? Managers have to consider native and nonnative plant and animal habitat needs, forest stand structure and composition, fuel levels, potential for high-severity fires, needs of threatened and endangered species, insect outbreaks, safety and potential evacuation of nearby communities, local economies, public and firefighter safety, changing future conditions, climate change, drought, etc.

9. Explain: Each individual or pair of students must prepare at least one relevant question for the guest speaker. Each individual or pair must ask one question or — if their questions have all been answered, they must ask a followup question. After the presentation, students will write a reflective paper on what they learned.

10. Have students write out their questions. You can review them ahead of time, if you wish.

When the guest speaker comes:

11. Have students get their questions out. Remind them of courteous behavior toward guests. Remind them that they will write a reflective paper on the presentation afterward.

12. Introduce the speaker, host the presentation, and have students ask their questions.

Assessment:
Explain: Write a reflection paper with a beginning, middle, and end. Explain how forests in the Sierra Nevada are different today than they were before Euro-American settlement and how this impacts the decisions of wildland managers.
**Evaluation:**

<table>
<thead>
<tr>
<th></th>
<th>Full credit</th>
<th>Partial credit</th>
<th>No credit</th>
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<tbody>
<tr>
<td>Active listening to guest presenter</td>
<td>Listened attentively, took notes, and asked 1 appropriate question.</td>
<td>Listened attentively and took notes.</td>
<td>Did not listen attentively or distracted speaker or other students.</td>
</tr>
<tr>
<td>Reflection paper: How are forests different today?</td>
<td>~Identifies at least 2 changes.</td>
<td>~Identifies at least 1 change.</td>
<td>~Answer is vague. Does not clearly identify changes.</td>
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<td></td>
<td>~Uses examples of individual species or ecosystem properties that have changed.</td>
<td>~Uses examples of individual species or ecosystem properties that have changed.</td>
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<tr>
<td>How do the changes impact decisions of wildland managers?</td>
<td>~Identifies how each change identified above affects specific decisions of wildland managers.</td>
<td>~Describes how change(s) affect decisions of wildland managers.</td>
<td>~Answer does not address decisions of wildland managers.</td>
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**Slides in**

**H19_A Photographic Interpretation.pptx**

*Slide 1*

*Slide 2*
… moved the camera to the right of the original position to avoid vegetation that screened the view. The increase in density, height, and canopy cover of live oak and chaparral is particularly apparent. Fewer pines grow on the bench at the distant right. On productive sites, Douglas-fir, ponderosa pine, gray pine, and black oak grow much more densely. Photo 2016-11-00002 by George E. Gruell, Special Collections, University of Nevada, Reno Libraries.

View southeast over the North Fork of the American River. Ponderosa pines are scattered over a landscape that shows no evidence of logging. On the midground slope to the left of the locomotive smokestack, low-growing live oak and chaparral appear sparsely distributed. Photo by A. A. Hart, courtesy of the Department of Special Collections, Stanford University Libraries.

The construction of Interstate 80 and the realignment of the railroad altered much of the former landscape. The original pine-dominated stands were cut after 1867. In their place grow dense stands of younger conifer containing a high component of white fir and incense cedar. Photo 2016-11-00003 by George E. Gruell, Special Collections, University of Nevada, Reno Libraries.

Emigrant Gap in Placer County was a key transportation corridor. Immigrant wagon trails left the ridge and dropped abruptly through the gap to Bear Valley below. Recent construction of the Central Pacific Railroad displaced vegetation along the right-of-way. The spacing of trees in the stand at the right and the lack of any sign of disturbance suggest that the stand had not been logged. Photo by A. A. Hart, courtesy of the Department of Special Collections, Stanford University Libraries.
Slide 8

Slide 9

Slide 10

Slide 11

Slide 12
after construction of the Western Pacific Railroad and a private lodge. Workers removed trees along the railroad right-of-way and around the structures. Photo courtesy of Plumas County Museum, Quincy, California.

Dense cover necessitated moving the camera to an opening lower than the original position and to the left of it. The increase in conifer density, height, and crown cover in this locality is marked. Trees block the view of the river and most of the railroad. Photo 2016-11-00006 by George E. Gruell, Special Collections, University of Nevada, Reno Libraries.

In his 1899 photo caption, Sudworth described this basin as having been heavily grazed by cattle and sheep. Charred remnants of trees in the midground attest to past fire. Lodgepole pine and red fir grow in patches. Lodgepole pine is reproducing in the midground. Photo by G. B. Sudworth, courtesy of Forestry Library, University of California, Berkeley.

By 1993, dense lodgepole pine and red fir had overgrown the 1899 camera point. I took this photograph from one of the few openings, about 100 yards to the left of the position used for the early photo and above it. The arrow indicates two trees in the distance similar to those on the 1899 photo. Photo 2016-11-00007 by George E. Gruell, Special Collections, University of Nevada, Reno Libraries.

Photo courtesy of Plumas County Museum, Quincy, California.
View southeast at Sierra Buttes, Sierra County, from the slopes above Packer Lake. The tinge of white appears to be a light covering of snow. The conifers, most of them red fir and western white pine, grow in a patchy, open pattern. Photo courtesy of Plumas County Museum, Quincy, California.

The size and density of the trees have increased markedly on sites with adequate soil. Little has changed on rocky or thin-soiled ground. Both species of conifers now densely cover former forest openings.