

## Teacher Key for Handout H15-2: Interpreting a Model and a Map

1. What tree species commonly occur in lower montane forests? What tree species commonly occur in upper montane forests? What species commonly occur in both forest types?

There will be variation in these answers, depending on how students interpret “commonly occur.” Here is one set of answers:

- Lower montane forests: ponderosa pine, incense-cedar, California black oak, Douglas-fir, sugar pine, white fir, canyon live oak
- Upper montane forests: Sierra lodgepole pine, California red fir
- Species that commonly occur in both forest types: Jeffrey pine, quaking aspen, white fir, sugar pine

2. Describe where on the map a red fir is most likely to live.

In the red-colored area

3. Describe where on the map you are NOT likely to find red fir.

Anywhere other than in the red area.

4. Which species on Sasquatch Peak has the smallest distribution?

Baker cypress

5. Suppose a California red fir lives at 1,800 m elevation and its habitat gets a lot warmer and drier. Are its seedlings likely to survive?

It could have trouble. 1,600 m is already at the lower (hotter and dryer) end of its range. If it got even hotter and drier, it would be hard for seedlings to survive.

6. As you head north from Sasquatch Peak, would you expect Jeffrey pines to grow at lower or higher elevations than where they occur in your model? Explain why.

Lower. As you head north, the climate typically gets cooler, so Jeffrey pines should be able to grow lower on the mountainsides.

7. What biological factors could make it easier or harder for a tree species' distribution to shift in response to climate change?

There could be many answers. Here are a few:

- competition with other trees, which stresses them
- seed predation, so it can't regenerate even if environmental conditions are good
- insects, fungi, or disease, so it can't produce seeds – or grow well in the new location
- soil-related and land-use issues, such as use of herbicides and disturbance of soil
- seed dispersal ability, so it can't deliver seeds far from the parent tree
- variety in the species' traits and the rate of genetic change occurring, which could produce traits adaptive to environmental change