

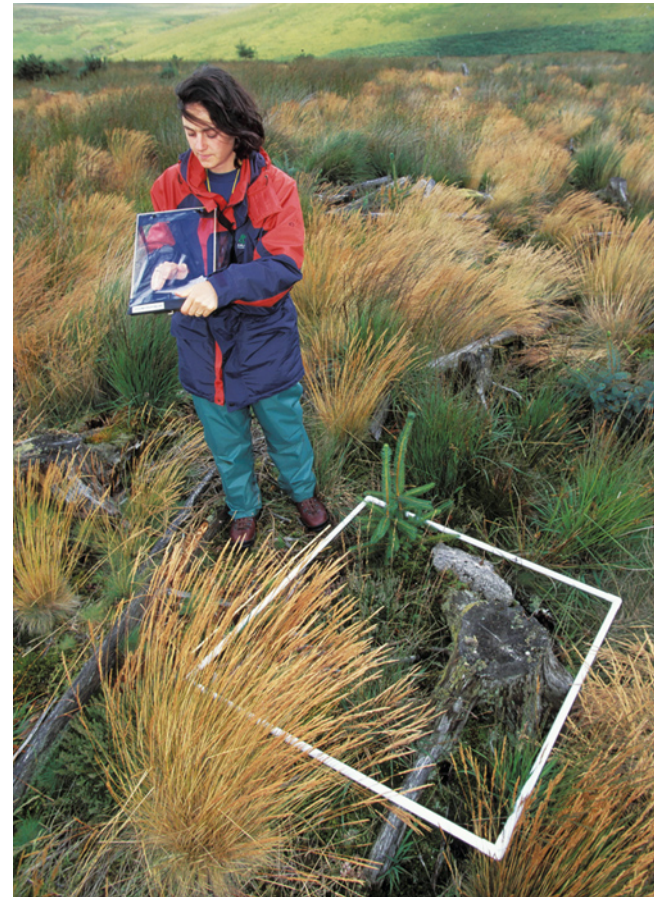
13.1 Ecologists Study Relationships

- ▶ **Ecological research methods** include observation, experimentation, and modeling.
 - **Observation** is the act of carefully watching something over time.
 - Observations of populations can be done by visual surveys.
 - **Direct surveys** for easy to spot species employ binoculars or scopes.
 - **Indirect surveys** are used for species that are difficult to track and include looking for other signs of their presence.



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- Experiments are performed in the lab or in the field.
 - Lab experiments give researchers more control.
 - Lab experiments are not reflective of the complex interactions in nature.
 - Field experiments give a more accurate picture of natural interactions.
 - Field experiments may not help determine actual cause and effect.



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- Computer and mathematical models can be used to describe and model nature.
- Modeling allows scientists to learn about organisms or ecosystems in ways that would not be possible in a natural or lab setting.

Ecologists use data transmitted by GPS receivers worn by elephants to develop computer models of the animal's movements.

