Chapter Review Questions for the California Naturalist Handbook

These questions were developed to help you review the chapters in the California Naturalist Handbook. Your instructor may choose to use them as homework assignments, or to simply provide you with a review tool.

The amount of information in each chapter varies, as do the number and complexity of the review questions. Have fun!

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Chapter 1 - California Natural History and the Role of Naturalists

1. California's Biodiversity
    a. What makes California such a hotspot for biodiversity?
    b. What are four characteristics of California that are unique in the North American continent?
    c. What is an endemic species?
2. Biodiversity threats:
    a. What are some of the key factors driving the losses of biodiversity worldwide?
    b. Specific to California, what are some of the most critical changes taking place?
3. Ecosystem Services:
    a. What are ecosystem services?
    b. What is the utility of developing monetary values for these services?
4. Endangered Species Act (ESA):
    a. What does the ESA do?
    b. What are four problems that impede effective implementation of the act?
5. Traditional Ecological Knowledge (TEK) and being a "naturalist:"
    a. How are TEK practices similar to "western" naturalist practices?
    b. How are they different?
    c. What are some local TEK practices that have influenced the landscape of our region of California?
6. Influential naturalists:
    a. Name two naturalists who influenced your thinking.
    b. What did they communicate that you think is important?
7. Classification of species:
    a. What is the "Linnaean Classification" system?
    b. How do we use it to describe species?
    c. What does it tell us about the relationships between organisms?

Assignment: Put together your first journal entry in your naturalist journal, using the format suggested in your book. Adapt it to your personal interests and needs.

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Chapter 2 – Geology, Climate, and Soils

1. What kinds of plate tectonic activities do we have in California?
2. How were each of the following mountain ranges in California formed:
    a. Sierra Nevada
    b. Coast Mt. Ranges
    c. Transverse Ranges
    d. Panamint Range
3. How do our mountain ranges influence our climate?
4. What does our location on the western edge of our continent have to do with our climate in California?
5. How deep are the Central Valley sediments?
6. Rock origins:
    a. What are the common local rocks in our area?
    b. How were they formed (are they sedimentary, metamorphic, or igneous)?
    c. What kinds of the above rocks do we have in our county?
7. What is the state rock of California? What kind of soil does it produce, and how is this important to the plants and animals living in these areas?
8. How do Mediterranean climates differ from continental climates?
9. Draw a precipitation map for a cross section of the state of California.
10. Draw a generic sample of soil stratification, with a description of each soil layer. What does our soil look like locally?
11. How does geology influence soil chemistry?
12. How do Carbon and Nitrogen move through the biosphere? Draw samples of their cycles to help yourself understand the complexities.
13. What are some of the social and environmental impacts of mining?
14. What are mycorrhizae, and why are they so crucial for plant survival and growth?

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Chapter 3 - Water

1. What is unique about the water molecule?
2. How much of the world's water is found in the oceans, bound up in ice, or as "freshwater?"
3. Draw the water cycle in a way that helps you understand and remember how water moves through the landscape, waterways, and air.
    a. Where does 60% of the water flow go?
    b. What happens to the remainder of the water?
    c. How does snow pack influence water storage and seasonal streamflow patterns? Rain on snow events?
4. What is the difference between an aquaclude and an aquifer?
5. What are endorheic or internal basins, and where do we find them in California?
6. How do salts accumulate in these basins?
7. Why is the southern part of the Central Valley considered to be an alkaline basin?
8. Our three biggest natural lakes in California are the Klamath Lake, Lake Tahoe, and Clear Lake. What is unique about each of these lakes?
9. How do we classify streams within watersheds? How is this useful?
10. Stream inputs (biological, chemical and physical):
    a. Biological inputs include what kinds of materials?
    b. What benefits do woody debris provide?
    c. What kinds of chemical inputs are important for stream processes?
    d. How do these inputs impact food webs?
    e. What happens when stream systems and watersheds become eutrophic?
    f. What is the difference between alluvial vs. colluvial forces in moving stream sediments around?
    g. How are sediments moved within a watershed?
    h. What are the causes and consequences of increased sediment loads in streams?
11. What is a typical pathway for a watershed to move through a landscape? What kinds of formations are common in what parts of the watershed?
12. What is a floodplain, and how are flooding regimes important for soils and wetlands?
13. Estuaries:
    a. How are estuaries formed, and what is unusual about them in terms of habitat?
    b. Are they oligotrophic or eutrophic?
14. The intertidal zones are rich with biodiversity. What factors drive that biodiversity?
15. What factors influence the high numbers of endemic freshwater fish species found in California? How do precipitation and streamflow patterns influence that diversity?
16. What factors are threatening the survival of many of California's freshwater fish species?
17. What are some of the big changes that humans have made in the last 150 years to California's watersheds?
18. How do dams change water flows and temperatures?
19. What do levees do to streamflow and how do they affect floodplain hydrology?
20. What kinds of changes have occurred in the San Francisco Bay Delta over the last 150 years?
21. How do the many small water catchments in the upstream parts of watersheds impact streams?
22. How is CA state water law changing?
23. What are some of the challenges we face in terms of water use in California in the future?

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Chapter 4 - Plants

1. Plant forms: What distinguishes a tree from a shrub, and an herbaceous plant from trees and shrubs? What is a liana?
2. What is an annual plant? A perennial plant?
3. Draw a generic plant with the following parts:
    a. Stem
    b. Buds
    c. Bracts
    d. Leaves
    e. Generic flower, with labeled parts.
4. Flowers:
    a. Which are the male and female parts of the flower?
    b. What are tepals?
    c. Where do you find nectaries?
    d. What are the fruits of plants formed from?
5. How long have flowering plants been around?
6. Pollination:
    a. Why do plants use animal pollinators?
    b. What is the general exchange between plants and their pollinating animals?
    c. What other ways do plants transfer pollen from one plant to another?
7. What are four ways that plants disperse their seeds to new locations?
8. "Plant communities" are a human construct, but useful because we lump plants by general habitat requirements, and are able to expect a generic set of plants under given conditions.
    a. What factors influence habitat types?
    b. What are the generalized characteristics of and threats to the following community types?
        i. Beach vegetation
        ii. Grasslands
        iii. Salt marshes
        iv. Freshwater marshes
        v. Vernal pools
        vi. Transitional marshes
        vii. Coastal scrub
        viii. Chaparral
        ix. Mixed evergreen forests
        x. Oak woodlands
        xi. Riparian forest
        xii. Coniferous forests
        xiii. Redwood forests
        xiv. Deserts
9. What does the word sclerophyllous mean, and why is it relevant?
10. How else to plants modify their leaves to deal with the drought conditions of the Mediterranean summer?
11. How are these plant communities impacted by the Mediterranean climate of CA?
12. Why do these climate types support such great plant diversity?
13. What are two key adaptations some California plants have to fires?
14. What makes invasive species problematic to California landscapes? What are some examples of problem species?
15. How was fire used as a traditional agricultural tool in California? What were some of the primary effects of fires on oak woodlands?
16. What are some of the plant communities highly managed by California Indians?
17. What are some of the changes we may see in plant communities given predicted climate change? Exercise: Choose a native plant you know well, and every year collect and press the first leaves in a journal. How does the budding and leafing change over the years?

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Chapter 5 – Forests, Woodland, and Range Resources and Management

1. History of California forests and their management:
    a. What are some characteristics of coniferous forests, and where are they found?
    b. What are some characteristics of broadleaf forests, and where are you likely to find broadleaf forests in CA?
    c. How much of each forest type is privately vs. publicly owned?
    d. What are some of the biggest threats to oak woodlands in CA?
    e. Who was Gifford Pinchot? What was his role in changing forest management in the United States?
    f. How did John Muir's philosophy influence forest practices on federal lands?
    g. What were some of the drivers for western forest conversion post World War II?
    h. How have recent practices incorporated a more "ecological" approach to forest management?
2. Forest dynamics:
    a. What are some forest disturbances that impact species composition, and the structure of a forest stand?
    b. What is succession? What species would you expect to see in an area recently exposed to a large disturbance?
    c. Where did Sudden Oak Death come from, and what are its impacts on oak forests in CA? How can we help prevent the spread of SOD and the Gold-Spotted Oak Borrer?
3. California forests and wildfire:
    a. What human and ecosystem benefits arise from managing forests with wildfire?
    b. How has fire suppression changed our forest structures?
    c. What are some of the challenges for reintroduction of fire as a forest management tool?
4. Fragmentation and forests:
    a. What are some of the key drivers for forest fragmentation in California?
    b. What are some of the problems created by habitat fragmentation?
    c. How does fragmentation create management challenges, and what are some tools that help mitigate habitat fragmentation?
5. Carbon sequestration:
    a. How do forests sequester carbon? If it helps, draw a diagram of the paths of C through a forest.
    b. Do you think that carbon credits for forestland owners through the California Air Resource Board will be an effective forest conservation strategy?
    c. What other recent changes in local economies are impacting forest harvest practices in California?
6. Rangelands and livestock grazing management:
    a. How are native bunchgrasses different ecologically than annuals?
    b. How do grazing animals influence the species makeup of grasslands?
    c. How can ranchers ensure long-term sustainability in their grazing practices?
7. Conservation biology:
    a. Of the 6 principles described on page 139 for ecological understanding, are there any that surprise you? If so, which ones?
    b. What is one of the recently recognized key tools for creating conservation plans?
    c. How do habitat continuity and size effect conservation efforts?

Recommended reading: The Big Burn by Timothy Egan

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Chapter 6 - Animals

1. Animal energetics:
    a. What is a heterotroph?
    b. What is a primary consumer vs. a secondary consumer?
    c. Are food webs always really this simple? Describe a food web for an animal you can observe from home.
    d. What do the following terms mean?
        i. Nocturnal
        ii. Diurnal
        iii. Crepuscular
        iv. Hibernation
        v. Torpor
        vi. Estivation
    e. Where are animals more likely to use hibernation vs. estivation as an energy conservation strategy?
    f. What is the difference between endothermic and ectothermic animals?
    g. Parental care: What are the advantages and disadvantages of having many vs. few offspring? What are the costs in each method?
    h. How are exoskeletons and skin similar?
    i. What are two examples of how animals engineer ecosystems?
2. Evolutionary groups: What are some characteristics of the following groups:
    a. Monera
    b. Protista
    c. Fungi
    d. Plantae
    e. Anamalia
3. Compare and contrast Invertebrates to Vertebrates (or, create your own table)

	Invertebrates	Vertebrates
Skeleton type		
Body segmentation		
Ancestral “type”		
Worldwide biomass		
Locomotion?		

4. What are characteristics of the following invertebrate types: crustaceans, spiders, millipedes, and insects (complete vs. incomplete metamorphosis?)?
5. What are some characteristics of the following vertebrate types: fish, amphibians, turtles/tortoises, snakes and lizards, crocodilians, birds, and mammals.
6. What are anadromous fish? How do they cope with the extreme changes in their environment?
7. What makes amphibians so susceptible to environmental changes?
8. How do bird adaptations maintain their capability of flight?
9. What are two strategies lizards and snakes have adapted to conserve water?
10. Why do snakes flick their tongues?
11. What is the difference between monotreme, marsupial, and placental mammals?
12. Where do you find the most diversity of monotremes and marsupials?
13. Human activity and domestic and introduced animals: What are some of the effects of domesticated and introduced animals on habitat in California?

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Chapter 7: Energy and Global Environmental Issues

1. Laws of Physics and Entropy:
    a. What is entropy?
    b. What is the general direction of energy?
    c. Can energy be "used up?"
2. Give an example of each of these forms of energy:
    a. Electromagnetic:
    b. Nuclear
    c. Chemical
    d. Mechanical
    e. Thermal
3. Sources of energy:
    a. What drives the global geological cycle?
    b. Where does the majority of energy for life on earth come from?
4. Back to that water molecule: What makes it such an important molecule for energy transformation on earth?
5. What are the two primary pathways for the storage of sunlight energy on earth?
6. What is respiration? How is it similar to combustion?
7. How does the food web contribute to entropy?
8. Energy use by people:
    a. What are fossil fuels? (i.e. what is the source of energy in fossil fuels?)
    b. At the current rate of consumption of fossil fuels, roughly how long can we maintain our contemporary lifestyles?
9. What are some advantages and disadvantages for each of the following energy sources?
    a. Fossil fuels?
    b. How does nuclear power?
    c. Geothermal?
    d. Wood as energy source?
    e. Solar?
    f. Wind?
    g. Hydroelectric?
    h. Wave and tidal energy harvesting?
    i. Ethanol?
10. Climate change:
    a. What is the "greenhouse effect?"
    b. What are three greenhouse gasses, and how are they produced? Which has the greatest longevity in the atmosphere?
    c. Is climate change preventable at this stage?
    d. What are some of the major effects of climate change?
    e. How does this specifically affect CA?
    f. What does an early spring mean for plant and pollinator phenology?
    g. What does sea level rise mean to coastal wetlands and the Central Valley?
    h. Why are the poor disproportionately affected by climate change?
    i. How will the Sierra snowpack impact our ability to mitigate and adapt to change?
11. Ozone depletion and production: Where do we want to find ozone? What agreement slowed the worldwide production of ozone depleting chemicals?
    a. How do we produce ground level ozone, and what are the impacts?
12. What causes "dead zones?" How can they be prevented or reversed?
13. Why are California farms smaller than the average US farm? What is one of the leading threats to farms in CA?
14. What threats to farms pose to salmon? How so?
15. Air pollution:
    a. What are the pollutants of most concern in California, and what are their sources?
    b. Why are we seeing higher levels of ozone pollution as our climate warms?

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16. Solid Waste:
    a. What are problems associated with landfills?
    b. How can we mitigate some of these problems?
    c. What is the most effective way to reduce our waste?
17. As populations increase and change in California, how does this change our conservation concerns and potential for action?

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Chapter 8 – Interpretation, Collaboration, and Citizen Science

1. Interpretation - why, what, and how:
    a. An interpretive talk: What are some of the core components of creating a good interpretive talk/walk?
    b. A naturalist walk: Describe a couple of types of naturalist walks that can help engage participants.
    c. What have you done that's been successful in engaging people? What would you like to add to your repertoire?

2. Collaboration in the community:
    a. Speaking at public forums: What do you want to keep in mind when you prepare a talk for a public forum? Aside from practice, practice, practice, what are some ways that you can help yourself create an effective speech?
    b. Running effective meetings: How can you help ensure that participants want to keep working with your group? What are some ways to help make a meeting functional?
    c. Collaborative conservation:
        i. What are important considerations for being inclusive in collaborations?
        ii. What are some of the pitfalls in trying to develop broad solutions for local problems?
        iii. How can we maintain a safe place for diverse stakeholders to express their perspectives?

3. Citizen science:
    a. Have you participated in any citizen science projects?
    b. How do these projects provide a broader perspective?
    c. Does quantity of data make up for potential flaws in data sets provided by participants who are not trained scientists?