

ES 10 Final Exam Review Questions

Here's a sheet with all of the questions both Wednesday sections have turned in since the second midterm. The format for these is the same as before—for some of these questions, I have answered them directly; for many, if I feel you can obtain the answer on your own, I refer you to another source that you have at your disposal. Other questions I've provided no hints at all—I'm not trying to be mean, but rather I am trying to give you examples of questions that either should be common knowledge to you by now or that you should be able to answer given your knowledge of the subject and your problem-solving skills. If you can't answer these, you need to learn the basic concepts more thoroughly. Finally, some of your questions have no cut-and-dry answer to them—I've left them in because I thought they were important issues that some of you have brought up, issues that all of you should think about because they will affect you.

All page numbers refer to pages in the textbook; all lecture dates refer to the handout given on that lecture. If you don't have the handouts, download them at www.cnr.berkeley.edu/classes/es-10.

Biocontrol

Don't we continue to disturb the environment when we add new organisms to the agriculture that reduce pests? Adding more organisms to get rid of the old - this solution seems temporary since these new organisms disrupt the ecosystem by overcrowding the crops with its populations.

If one were to introduce an exotic natural enemy into an ecosystem to control a certain pest species, is there a high risk that the natural enemy may in turn become a future pest problem that would need to be put under control?

Yes!! This is why all of these organisms must be tested extensively before they're released.

What are some of the cases of biological control gone bad? I mean like exotic predators they bring in must have adverse side effects on the surrounding ecosystem sometimes.

The mongoose was introduced to Hawaii to get rid of non-native rats—but the mongooses ate the native birds instead. There are many more examples—see 27 April handout.

I was a little unclear of why pesticides don't work. Can you explain the different ways of why they don't?

Resistance to the pesticide increases with each generation, plus because they kill natural predators, those insects that were being controlled by them tend to become pests as well.

What is the bacillus thuringiensis(BT) and what's its effect on the environment?

This is a bacterium that has a protein in it that will kill caterpillars that eat it. The gene for this protein has been spliced into the genome of many crop species.

Why was DDT, a toxin used to kill pesticides, eventually banned if it was so effective, efficient, and inexpensive?

DDT had many undesirable effects on the environment—probably the most high-profile would be the weakening of birds' eggs—many large bird species became endangered because of this.

What are the other alternatives to insecticides?

I was wondering what the TA that lectured on pesticide use said about the question on farm productivity. If these pesticides are failing, why can the farms still produce a lot of food? Is it because of nutrients added?

Even though pesticides lose their usefulness over time, crops also have tons of fertilizers put on them, plus new strains of crops are constantly being produced.

Also, what was his technical definition of a pest? What are some of the negative effects of biological control?

What is the difference between a parasitoid and a parasite? Are wasps/flies or the wasp/fly larvae classified as parasitoids?

A parasite lives on/in its host and does not kill it—it is dependent on it. A parasitoid spends some part of its life cycle on/in the host, eventually killing it. Parasitoids require other resources as well.

Usually how long does it take for a biological control to have apparent effects?

CA grasslands

How are serpentine soils formed? What is serpentine rock and how does it weather? Could you clarify the relationship between calcium and magnesium in rocks? Is a rock considered ultramafic if it contains Mg instead of Ca? Could you go over the relationship between the Mg and Ca with regards to soil type? What kind of metals are in serpentine soils that contribute to their toxicity?

Serpentine soils are derived from serpentinite, a metamorphic rock that forms deep under the surface of the earth and is uplifted to the surface. Serpentine soils are high in Mg, which interferes with Ca uptake in plants. They also contain heavy metals, such as Cr and Ni, which are toxic to most plants.

What are the effects serpentine soils have on the environment, plants, and other wildlife habitats? If serpentine soils demand such specialization, are they still threatened by invasive species, or mostly human removal/development?

Serpentine soils are difficult for most species of plants to grow in, so a fairly specialized set of plants grows there. Because these are difficult conditions, they have tended to be resistant to invasion, although some exotic species are starting to be able to grow in serpentine areas.

I don't think I understand the vernal pool very well. What exactly is the vernal pool? The professor just talked about a few things that happen there, but not an explicit definition. Where are vernal pools found. In Southern CA mostly or are there some up in Northern CA. What conditions are needed for there to be a vernal pool? What are Mima mounds again? I remember them being about vernal pools and prairies, but how do they relate to that?

Vernal pools are areas in the grassland that are seasonally inundated with water—so in the rainy season, they're submerged, but in the dry season, they're completely dry. These form in small depressions with an impermeable clay layer under the soil surface. Mima mounds are the raised areas between vernal pools. Vernal pools are found throughout CA, but primarily in areas with grasslands—e.g., coastal areas, Central Valley.

Why do plants have a hard time growing in vernal pools?

Think about the environmental conditions here and why plants might not do well in them.

What are the contributions of vernal pools? What kind of productivity do they provide?

Vernal pools have a large number of endemic species in them. These unique pieces of biodiversity are important to conserve because they occur nowhere else.

On the lecture 4/16/2001, what was the significance of Clements' hypothesis of railroads affecting bunchgrass? Can you clarify Clements' hypothesis?

Clements thought that because railroad right-of-ways had bunchgrasses in them and because those areas hadn't been disturbed by cattle (because of fencing), they must represent relictual populations of the native ecosystem. This is somewhat problematic, though. While the right-of-ways indeed weren't grazed, they caught on fire frequently, which may have favored the bunchgrasses.

How did perennial grasses become a native species to CA grasslands if annuals are so much more favored reproductively?

Perennial bunchgrasses were here first—they evolved here, that's why they're native!! If there aren't any of the exotic annuals here, they do great.

Why don't native plants return?

How come removing grazing and agriculture doesn't restore the native grass?
 How did the introduction of new livestock/grazing practices affect CA grasslands?
 Why don't grazed lands turn back into original prairies in succession?
 How do exotic annuals keep out perennials?

With natural disturbance (fire), why can't the native grassland return?

In CA, the annuals are superior competitors for resources when they are seedlings, when compared to perennial seedlings. So, even if grazing is removed and the fire is reinstated, unless one can completely remove all the annual seeds, they'll tend to dominate.

How did palm trees arrive to California when they are a tropical plant?

Think about the means by which plants are introduced...

How come oaks form a "bathtub ring" around grassland?

This ring is at an elevational range that favors oak woodland rather than just grassland or other more dense forest types.

Human energy use

Wouldn't the burning of fossil fuels ultimately place constraints on the carrying capacity due to the global warming trends and air pollution?

What is the difference between fission and fusion and are they both a part of nuclear power?

Fission is the splitting apart of an atom into 2 separate atoms; fusion is the combining of 2 separate atoms into one atom. Fission is the reaction used currently for nuclear power; fusion is still being researched.

What makes nuclear waste so dangerous?

Radioactive isotopes release radiation—this causes genetic damage to organisms, either deforming the organism itself or damaging its future offspring. Nuclear waste is radioactive—thus highly dangerous to humans.

Why is fossil energy more efficient than wind and solar energy?

Can you explain how the biomass and solar energy cycles work? What are peatlands?

Biomass energy comes from combusting plant material and trapping the energy that is released. This biomass often comes from peatlands—which are more or less bogs—think of Ireland. Solar energy can be trapped by a photovoltaic cell to convert that energy into electricity.

Will we have to know the various ways electricity is generated for human use?

What do you think? ☺

How do we accommodate energy needs of a growing population? This question was on the lecture handout, but Inez did not get to it.

Why isn't there a max on the amount that energy producers and suppliers can charge for energy?

Would regulating the price that electricity is sold to PG&E help the energy crisis?

If we deregulated both power wholesales and power distributors in the first place, the price of electricity would be lower. Why? Won't it be higher?

I don't really know why the state chose to deregulate in the manner they did, but the idea was to create more competition between suppliers and distributors to ultimately decrease the price of energy. If you are still interested in this problem, read the newspaper—there are stories on this nearly every day.

Would it be possible to harness the energy created by people working out on machines at the gym to add to the energy supply? Otherwise, all the work done is wasted as heat.

Field trip

How have invasive species affected the Berkeley ecosystem?

What kind of biome is the area we live in now? Well, before the urbanization and what not of course.

What affects compass readings so that we need to accommodate 15 degrees? I thought it was an iron-ore mine in Canada, maybe it is and I missed it, but it sounded like he said something else.

Magnetic north is not at geographical north. The iron core creates an electromagnetic field, which creates two poles. Magnetic north pole is somewhere under Hudson Bay in Canada, so our compass here point more east than True North really is. We know that this deflection is about 15 degrees, so we can set our compasses to accommodate that. The actual # of degrees (called the declination) depends on where you are on earth.

What are the characteristics of annual and perennial plants?

If eucalyptus trees produce flammable oils, do they have a higher percentage of forest fires?

How do you spell "allelopathy" and what does the litter of the eucalyptus alter about soil to make it unlivable for other species?

Allelopathy means that a species releases some sort of chemical into the soil to inhibit the establishment or growth of another species—this can be through roots or through litter. These are typically called "secondary compounds".

How big and when is the predicted earthquake that is expected to hit California? What will happen to our campus? Memorial stadium?

Fisheries

Is "lifestyle" the only classification of marine biota?

No—you can classify organisms any number of ways—taxonomically, lifestyle (or functional group), size, whatever is pertinent to what you are asking.

Why did Professor Fung say that photosynthetic plankton were smaller in the tropics?

The water is less dense in the tropics than in temperate regions, so the plankton have to be smaller to stay buoyant.

I was confused about the terms, plankton, zooplankton, and phytoplankton. What is their relationship?

Is a shark a nekton too? Is that a family or class category?

Can you explain the different bands/zones for benthos?

*Plankton are floating organisms—the plant plankton are called phytoplankton, and the animal plankton are called zooplankton. These terms (plankton, nekton, and benthos) are **not** taxonomic designations—they are functional groups, so they aren't at either the family or class level (terms which relate to taxonomic classification). Benthic organisms are usually zoned based on the degree of exposure to air—think of tidepools and how the upper regions are exposed for much more time than the deeper areas.*

Why is biodiversity greater on land than in the ocean?

Why is the coastal zone higher in productivity?

So the upwelling is off the CA coast right? So where is the downwelling caused by the Ekman transport?

Could you go over the coastal regions sketches discussed in class relating wind and water?

How does the Ekman upwelling process work?

All of these questions relate to each other—see your notes on fisheries as well as on oceanic circulation.

What's the significance of the Atlantic Cod?

How are the harvest rate and the recruitment rate related?

To sustain a fishery, what else do you need besides making sure that the population is large enough so that reproduction can occur?

Forestry

What were the contributions of Mulford and Vaux?

What is the exact process for the creation of charcoal?

Wood is combusted in a reducing environment, i.e., without oxygen, so that all the water burns off, plus other non-carbon compounds. The remnants are charcoal.

In the last lecture, the professor mentioned something about "commercial" forestry. What was the significance of that?

See p. 260-261

In lecture on 4/11 Monocultures were contrasted with plantation forestry. I was just wondering if you could clarify the differences between these two .

These aren't really that different; plantation forestry is planting/growing trees to harvest in the future—and because usually only one species is planted, a monoculture is formed.

What is forest productivity on the west coast? Is it enough to meet the minimum production requirements (1.4 m³/ha/year)?

What are different ways of managing primary and secondary successions in forests? How is it different in different areas?

What makes wood adequate for structural purposes?

Why do forests have high biomass?

What is the mean annual increment?

This is the amount of biomass accumulated per hectare of forest per year.

When and how does the process of controlled burning work?

Why do we try to prevent forest fire when we know that controlled burning promotes biodiversity?

Does controlled burning affect the fertility of soil? If yes, in what ways?

We do controlled burns for various reasons. First, fire is a natural part of the ecosystem, so doing controlled burns reintroduces that process into the system. Many species' seeds require fire to germinate; burning also adds nutrients that are tied up in dead wood back into the soil. But because burning has been excluded from these systems for so long, letting "natural" fires go unchecked is no longer an option—these fires burn hotter and faster than they would have in the past, plus there are too many human structures in the way. Controlled burns achieve similar results as a natural fire but with a somewhat lower risk.

Is softwood or hardwood more prevalent in forests and why?

In the same lecture Prof. Bartolome was talking about the differences b/t hard and softwoods, I was just wondering where these are distributed (separately in different regions or together)?

Whether a forest is hardwood or softwood depends on climate; warmer areas tend to have hardwoods, and cooler areas are dominated by softwoods...and there is a whole gradient in between (this gradient can be based on elevation or latitude). Hardwoods have denser wood and are used for construction lumber; softwoods have less dense wood and are used for pulp and paper products.

In lecture, Professor Bartolome talked about the actual structures of trees and what they need to grow like in order to fight for light...there were four characteristics and I missed the last one...light, resilient, strong, and resistant to decay.
These were characteristics of wood that make them useful to humans: light, resilient, strong, and resistant to decay.

What is the definition of Transitory Range?

Range that is only available at certain times—like after a harvest in a forest, where there are lots of herbaceous plants growing.

What type of forest has been affected the most by human impact?

The forests in North America tend to be "filling in." What is the likelihood of canopies being reformed?

There are two "filling ins" that are occurring in NA: the regrowth of Eastern forests and the closing of the canopies of Western forests. The process in the East is great—it's reverting to the natural ecosystem. In the West, the "filling in" is because of fire suppression, so this creates a more dangerous fire hazard overall; this process is taking the forest away from being "natural".

What does secondary growth have to do with cutting methods like seed tree cutting?

What's the difference between seed tree cutting and selective cutting?

Can you explain shelterwood cut methods?

See p. 267

When we only use 40% of the 50% of the wood we cut, what do we do with the rest?

We sometimes use the pulp for paper products or burn it for biomass energy...

Biodiversity "ownership"

In class we learned about the idea of turning over internationally accessible resources to nearby, local populations who would presumably be better stewards and use these resources more wisely. Are there any instances where this has been done, and, if so, what was the outcome?

What are some possible ways to instill the value of conservation of natural resources in people? How can people be made to feel like stakeholders in the care and protection of natural resources?

In today's lecture, what is the significance of the Galapagos Islands?

This was one of the examples of ownership issues regarding biodiversity—who owns the fish in the Galapagos? Humankind (as in keeping them as a preserve) or fishermen?

Misc

What are the three things apparent in a biological system when various concentrations of a chemical or toxic factor are present? (referring to the Concept of Dose and Response on page 299)

Read the rest of that paragraph on p. 299—the authors discuss the patterns one finds between the size of the dose and the type of response that results.

How does the LD-50, ED-50, and TD-50 work and what exactly are they besides lines on a graph?

These are the doses of an element/chemical/medicine/etc that cause a lethal, effective, or toxic (respectively) response in 50% of a population. This helps one determine what levels of different substances are acceptable to have in a population.

What are electromagnetic fields (how are they formed)?

The electromagnetic field surrounding the earth is a result of the earth's spinning and the fact that the earth has an iron core.

This is a random question, but I thought I might ask it. How do they use the gypsy moth to make silk?

I'm not sure! Maybe people use the silk it spins to make its cocoon? Look it up on the web...

Do human species fall under the category of invasive species?

I think so!

If Humans are the most invasive species on the planet and therefore have the potential to do the most harm and the most good, how do we convince a person to consume less and live in a more sustainable way, especially in a capitalist system where consumption is a sign of success?

This is a great question—and I don't know the answer. A good start is to be an example yourself—to show other people that one can live "smaller" and still be happy.

What is the status of the recycling of polymers? Most polymers, such as tennis shoe soles and car bumpers, are in fact recyclable. Are they being recycled?

Check the web...I'm not sure.

How do people account for the lack of marine (none) and plant (very few) extinctions during the Pleistocene?

Mass extinctions of marine organisms have tended to coincide with large tectonic events that reduce the amount of continental shelf—such as when two continental plates collide. The Pleistocene extinction was driven by climate change—and we learned that climate will change faster on land than in the ocean. Although many plants didn't go extinct, they now have reduced ranges. Many plant species are only found on mountaintops because that's the only place with a cool enough climate for them now (when they used to be more widespread).

Is there really a shortage of timber in California?

It depends on who you ask... ☺

Does anybody have a answer on how to save the oaks in the Bay Area?

Is the problem with the dying of oak trees around the bay area a very serious problem?

Researchers are working on this as we speak—this is a huge problem; one that most people would like to avoid. In other parts of the US, all the chestnut trees have died, as well as elms, because of introduced pathogens—so this is very serious for us.

How much of strawberry canyon is owned by UC and how much by the cities of Berkeley and Oakland?

I believe the UC owns all of Strawberry Canyon.

Why do some people say that it is more ecologically correct to be vegetarians when ruminants can convert otherwise useless materials into protein and therefore used as a human food source?

See the extra credit worksheet to see for yourself. Because of the nature of energy transfer between trophic levels (only 10% of the energy in one level is incorporated into the biomass of the next level), it takes about 10 times the amount of plant material (and therefore, water, land, pesticides, etc.) to feed a cow than it would to raise a crop that would provide the same number of calories. Of course, in some areas, crop agriculture is not an option, and livestock are the only means of getting sustenance from the land. But in the US, cattle aren't generally eating "useless materials"—they eat grass, sure, but spend a large amount of time eating agricultural products (such as corn) that are raised for them. Eating lower on the food chain (or eating fish, because they feed themselves) is one way to reduce the amount of chemical and water inputs into the land.

What is the nutrient cycle?

See Ch. 4.

Now that there is more known about how to maintain populations of animals and plants while also taking them for human use, is there still the same threats of extinction to these species? In other words, has the work done by the logging industry and fisheries helped to maintain the populations of the species they harvest. Is there is abuse of the "laws" (like harvest < recruitment rate or that forests must not be logged until they have reached a certain stage of re growth) of these industries?

There are still threats of extinction due to habitat loss—but as far as direct harvest, the situation is much better (although not completely wonderful) than before. It takes businesses a while to realize that even though it might cut profits now, in the long run, sustainable harvest of fish/trees is the most economical option.

How does the retreat of glaciers affect the processes of soil formation and development?

Glaciers leave behind a huge mess of unsorted rock and material that was formerly soil. New soil (and ecosystems) develop from this moraine through the process of primary succession.

What trophic level do crabs fall under? In regards to how crabs effect the ecosystem, because the SF Chronicle article only focused on the Asian invasion.

Crabs are typically detritivores—they eat undecomposed organic matter. But others are herbivores, and probably some are carnivores.

What is the government doing to try to keep invasive species from taking over ecosystems?

Whose govt? Ours? The US government requires certain notoriously noxious weeds to be controlled by law, but for other more widespread invasives, they leave it up to the individual landowner to decide whether to control them or not.

What are the methods of restoring native growth to areas that have previously been occupied by eucalyptus?

How has the agriculture in California's Central Valley affected the wetlands that once covered the area?

What are the possible environmental impacts of opening the Alaskan National Wildlife Refuge to oil drilling?

What are some current environmental policies that are being proposed? And how do the policies that we make in California affect the rest of the world?

Read the New York Times (or at least the Chronicle), because these issues are discussed nearly every day!

I was driving in San Francisco on 101 the other day and I noticed that there are lots of illuminated billboards. One Coca-Cola one has lights all over it. Are we not in a power crisis? Is there anything the city or state can do to shut off the billboards or at least the ones who have unnecessary lights?

The state could require the billboards to be shut off or fine those who don't do it voluntarily.

Do ecosystems that are geographically far apart affect each other and how?

Yes. Ecosystems interact through the biogeochemical cycles—water, nitrogen and other nutrients, carbon, etc. Also, ecosystems are linked by organisms that have large home ranges—such as migratory birds, large animals, and insects. If one ecosystem is destroyed, and a certain species is dependent on it and goes extinct, the other ecosystems it also uses will be affected as well.

Are some ecosystems easier for humans to redevelop than others? Which ones?

Parks

Do you think the reintroduction of the Grey wolf in Yellowstone was a good idea or a bad one? Especially since it wasn't the same type of Grey wolf, but just a near relative?

I think it was a great idea—the entire Yellowstone ecosystem has been thrown “out of whack” by having all of its top carnivores eliminated—the prey populations in the meantime have exploded, which is negatively affecting not only the vegetation in the park, but also the health of the herds. The system can now reequilibrate, and there will still be plenty of game (and healthier ones at that) for hunters.

The guest lecturer last week was very interesting and I just had a question about something she said. She mentioned that first the park banned wolves from being part of the ecosystem, but then they introduced them again into the park. Why would they want to do that if they also want to preserve some of the animals there, like Bison? And what makes wolves so special in the park, what are their roles?

See answer above. Also, wolves won't eat everything—but they will tend to eat weaker animals, thereby strengthening the future herd.

Sometimes preserves are created and endangered animals are brought in, such as the tule elk in Tomales Point. Is there a high rate of disease among these animals, and if so, what are the causes?

Species with small populations are more likely to be susceptible to diseases and genetic problems, mostly because there is very little genetic variability between the individuals in the population. Genetic variation is the key to having some members of populations be resistant to disease, and when population sizes go down (I think the Tule elk was down to 4 elk!), the amount of genetic variation in the population decreases.

Pastoralism

Can you clear the concept of transhumance--4/18 lecture?

Can you please clarify the differences between Transhumance and Nomadic Societies? Which are more prevalent and which are more successful in terms of agriculture?

Nomads have no fixed location where they spend a predominant amount of time, although their travels are far from being random—they follow patterns they may have followed for centuries. In transhumance, there is more of a seasonal migration of animals, typically going into the mountains in the summer and down in the valleys during the winter. Which of these a group of people might use will depend not only on their traditions, but also the landscape (if there isn't any seasonal variation where you live, you would probably be a nomad) and the political situation.

Prof. Lynn Huntsinger mentioned the concept of an open access system and some of its values. What is an open access system? How is it important to ecosystem management?

She contrasted open access with common property systems. In open access, no one owns it or makes rules for the land's use or can exclude anyone else from the land. In common property, a group of people have rights to the land and can decide how to use it and who can use it. Westerners tend to assume common property systems are open access and treat it as such. For sustainable pastoralism to occur in many of these areas, common property must be recognized as a legitimate form of property rights.

Human population

Which theory of how people fit into the biosphere (exemptionalism or environmentalism) seems more plausible? I'm thinking the latter.

In class, a figure was said about 30 people per square kilometer. Is that how many people the earth is currently sustaining or is that an estimate of the number of people the earth can sustain?

That's the current estimate of human density on land.

Was Malthus' main point to show that a carrying capacity does not exist? How can the carrying capacity of the world be made if the number of birth and death rates are changing?

See p. 77.

Bartolome discussed in his last lecture the machine age and Malthus's findings and the exploitation of energy, but what does this have to do with human population and how does it affect us?

See p. 77.

Can you review the concept of carrying capacity? Is there a specific formula? Is it an estimated or concrete figure?

See p. 87-88.

At the current rate of population growth, the number of resources available, and the carrying capacity of the Earth, is it likely that the human population will tend to level off over time as in the logistic population model, or will extinction be the inevitable path of the human species?

See p. 83-91.

In lecture on 4/20 professor Bartolome referred to "demographic Inertia." I didn't quite catch the definition and was wondering if you could clarify this.

Because people are long-lived, any changes we make to fertility rates will not show up in population size trends for a long time, but it will show up eventually.

Our level of understanding of human population has not reached control yet. I understand the possible need for it, but how has it been attempted so far?

Well, a good case study of this is in China, where people are limited by law to having only one child. This has given rise to a huge number of issues—including the large number of female babies that are killed because families tend to want boys over girls (to carry on the family name). There are many educational efforts underway around the world, not only to educate people about birth control, but also to educate girls in general—there is a strong correlation between how well-educated a girl is and the number of kids she'll eventually have.

Remote sensing

The guest speaker went over three different remote sensing systems, but I don't think I understand it well enough. What's the main difference between Thaddeus Lowe's Balloon, Corona System, and Electro-optical system? Can you give me an example for each one?

See the 2 April handouts, and especially check out the websites he suggests.

What is the satellite index, and why does the satellite index increase when rainfall increases?

The satellite index that was talked about in lecture was one in which a comparison of the amount of infrared and near-infrared light that is reflected off the surface of the earth can tell you how much vegetation is present in that area. In the example of desertification of Sahelian Africa, they compared rainfall with this index and found that as rainfall went up, so did the value of the index. This isn't surprising—if you have more rain in a desert, you'll get more vegetation. But they could use all the index data over time to prove that the Sahara was not expanding over the last 20 years.

Were most models of remote sensing built for military purposes, then later used for environmental research?

They still are usually built for military purposes—but some of the information is not classified and can be used by scientists.

Can you please explain what PAR is?

PAR stands for "photosynthetically active radiation"—these are the wavelengths in the electromagnetic spectrum that are used by plants for photosynthesis.

In the guest lecture, how do you get false color imaging?

For all non-visible wavelengths that a satellite detects, it assigns a visible color so we can see what the patterns are.

Restoration

What position do most environmentalists take when they consider ecological restoration? Do more favor the Clementsian view that a state of equilibrium will eventually be reached in nature after a disturbance, or do more favor the view of the chaotic state of nature, which is inherently unpredictable? Depending on which position is chosen, how does this type of reasoning minimize or increase the difficulties in ecological restoration?

I think most ecologists see that ecosystems are dynamic—not necessarily completely unpredictable, but definitely more difficult to control. This is much more difficult to restore—it's easy to put in all the species that should be there, but it's more difficult to get them to interact with each other and with the environment in the way they should. But that doesn't mean we shouldn't try to do it...

Can you have an increase in spp. richness in coincidence with a decrease in spp. diversity? A decrease in spp. richness in coincidence with an increase in spp. diversity? EXAMPLES?

Since diversity incorporates both richness and evenness of species, these options you mention are indeed possible. The best example would be dealing with some superior competitor for resources. When that species is present, it is so dominant that it reduces the numbers of the other species (although not causing them to go extinct), reducing the evenness and therefore the diversity of the system (but increasing richness). Conversely, if one were to remove that species, richness would decrease, but evenness (and diversity) would increase.

Why is pH an obstacle for restoring vegetation?

What kinds of obstacles are involved in restoration?

See the 30 April handout from lecture.

What exactly is the meaning of nature? This was mentioned in lecture but never really clarified. Is there a meaningful definition that we should know?

Nature is usually thought of what would be in an area without human intervention. But you see the problem with this definition, since humans have been impacting ecosystems for hundreds of thousands of years—knowing what's not been affected by humans is probably impossible to ascertain.

Although I would like to restore ecosystems back to their natural habitat, I am unconvinced after Mondays lecture. Why do we not know which ecosystem to restore natural habitats to? And how can we increase the understanding of relationships between species to determine a new ecosystem that is beneficial to all those involved?

What you restore an area to will depend on what your goals are—if you are mitigating a toxic spill, you may be satisfied with cleaning up the toxins and getting any plants to grow there. If you are trying to restore a piece of CA grassland, you might try to determine what organisms were there previously and use that as your basis for restoration. No doubt, restoration does involve a huge degree of human judgement calls, but oftentimes, one doesn't have a choice of whether to restore an area or not—one just has to.

When we do "restorations," it seems like humans dictating what the new ecosystem should be like. I understand the need for restoring but are the decisions on what to restore to sometime self-interested?

See answer for question above. Yes, one can be self-interested yet still create an ecosystem that is better for the environment as a whole and that interacts with the surrounding ecosystems in an appropriate way.

In the last lecture, the GSI compared the nature in "balance" and the nature in flux. It wasn't really clear to me what he meant by "open" and "closed". What exactly is the main difference between these two and how do they help to define the nature?

A closed system is one in which there are no factors external to the system that affect it. For instance, the carbon cycle on earth is a closed system—carbon doesn't enter or exit the earth as a whole and only cycles within it. However, the carbon cycle for the state of California is an open system—not only is carbon exported through runoff into the ocean, but fossil fuels are brought in from abroad and

changes in the atmospheric carbon caused by other places will affect our atmosphere as well. Closed systems tend to be more in balance—they aren't characterized by constant change. Open systems, however, have so many external influences that even if one of them returns to a "normal" level, another one has changed in the meantime—so the system is constantly in flux.

Wildlife

I was wondering how you find the carrying capacity.

See p. 242-243. A rough way to estimate the carrying capacity for a piece of land for a given animal is to first quantify how much of what it eats is available in a given amount of time (e.g., there are X kg of it's food that grows on this land in a year), then figure out how much one animal eats during that same time period (e.g., one animal eats Y kg in a year). Divide the amount of food by the amount of food per animal to get the number of animals that that piece of land can support in a year (e.g., $X \text{ kg}/Y \text{ kg/animal} = X/Y \text{ animals}$).

What's the difference between existence and on-site values?

On-site values are economic values—we use the organism for food, sport, labor, etc. Existence values are our values for organisms simply for the sake that they exist. For example, people give lots of money to save endangered species in Africa and Asia (think gorillas, rhinos, pandas) not because we hope to use them for economic benefit in the future, but rather because we like to know that they exist somewhere other than a zoo.