Geography 141 -- Exam 2 Review

The final exam is based on the lecture material we have covered in class since the midterm exam. As you study for the final, you should focus first on lecture notes and lab exercises. The reason I provide the materials you have seen in lectures and labs is because I think that these are the most important facts, skills and concepts to understand. For that reason, the test will focus on these same points as well. Use the book as a very important secondary resource to clarify points of confusion and provide detail that we do not have time to get into during the lecture period. The following is a list of topics that you should emphasize in your review.

Unit 18

Natural climate change, statistical nature of climate change, climate change happens at multiple timescales simultaneously (for example, getting warmer on the scale of centuries, but colder at the scale of tens of thousands of years), not everywhere experiences the same average change. Past climate indicators such as various geologic formations, ocean and lake bottom cores with pollen grains, microorganisms, etc, ice cores. Oxygen and carbon isotopes (O-18:0-16 ratio; more ice, richer O-18), many other climate change proxy measures. Ice-albedo feedback, CO2-weathering feedback, hot-house climate, ice-house climates, snowball earth, glacial/interglacial cycles, last glacial maximum (LGM), sea level change, Milankovitch cycles, ice-core records, climate over the past 20,000 years, Younger Dryas, medieval climate anomaly, Little Ice Age, temps since 1850.

Unit 19

Human impacts on climate, global warming, anthropogenic climate change, anthropocene, Processes: adding heat, modifying the land surface, changing atmospheric composition Early Anthropocene hypothesis, temperature change in the industrial period, data making up global temperature records over the past 150 years – quality and trustworthiness, alpine glacier changes, spatial patterns of warming. Implicating humans in observed global warming, other greenhouse gases such as methane, nitrous oxides, CFCs. General circulation models (GCMs) and understanding the temperature response to greenhouse gas emissions, modeling issues and model runs, forcings, different models and ensemble runs, simulations vs. observations, release scenarios (such as CO2x2), predictions from various scenarios & consequences, disappearing climates, water vapor increase and positive feedback, climate change and weather extremes

Unit 20

Climate, soil, plants, and animals. Pedology, biogeography (phytogeography, zoogeography). Geography of soils, soils as an interface between biotic and abiotic systems, rates of development, relationship of soils to biota, effects of farming. Biogeography, biogeography as a very visible response to global change, species, spatial distributions on the earth & why, threats to the biosphere & biodiversity such as erosion and forest destruction.

Unit 24

Biogeographic processes, photosynthesis by bacterial and later plants – conversion of water and CO2 into carbohydrates and oxygen, chlorophyll, tree canopy crown geometry and latitude, Respiration – organisms use oxygen to break down carbohydrates and release energy, water, CO2. Animals also feed on plants (thus returning more CO2 through respiration), and bacteria and fungi also decompose dead plant material, converting it to CO2 through respiration. Limits

of photosynthesis due to heat increasing respiration and also through limiting availability of water, stomata. Biomass (total biomass/phytomass), primary producers, net primary productivity, global distribution of net primary productivity. Ecosystems, food chains/webs, autotrophs, herbivores, carnivores, decomposers, trophic levels. Energy flow through trophic levels means there are far fewer organisms at higher trophic levels, trophic cascade, trophic collapse. Plant succession, disturbance, primary succession, secondary succession, climax community. Geographic dispersal, optimum ranges for species, zones of physiological stress, zones of intolerance, Physical factors (Temperature, availability of water [xerophytes, deciduous vs. evergreen trees], other climate factors, distribution of soils, landforms), Biotic factors (competition, amensalism [one species inhibited by another], predation, mutualism), Disturbance, Species dispersal vs. vicariance (like Gondwana splitting), endemic species.

Unit 25

The global distribution of plants, biomes, terrestrial vs. marine, Primary factors: climate and terrain, climate factors: (1) atmosphere and its circulation systems [which determine moisture-carrying air masses], (2) solar radiation, terrain factors: (1) distribution of the landmasses and ocean basins, (2) topography of the continents. Relationship of latitudinal transition of biomes to altitudinal ecotone transitions in high mountain areas [von Humboldt]. Principal Terrestrial Biomes (1) Tropical Rainforest (Af, Am, sometimes Aw climates), dominated by tall, closely-spaced evergreen trees, multi-level canopy structure, presence of epiphytes and lianas, leaf litter decomposition, monsoon rainforests. (2) Tropical Savanna (in Aw climates), thorn forests, lower trees, fire and grass mat, deciduous trees such as acacia and baobub. (3) Desert (BW and BS climates), sparse vegetation, perennials more dominant in savannas, ephemerals more dominate in deserts, succulents, root structures of trees, cacti, etc. (4) Temperate Grassland (BS climates), climate-controlled, tall-grass & short-grass prairie, organic-rich soil, grazing animals, agriculture, (5) Temperate Forest, several varieties including temperature deciduous forest biome (in Cf climates) – oak, beech, birch, walnut, maple, ash, some conifers, temperate evergreen forest (in Cf or Cs climates) – needle-leaf trees in northern hemisphere such as doug firs and redwoods. (6) Mediterranean Scrub (in Cs climates) – pine, oak, hot dry summers and cool moist winters, California/Mediterranean, central Chile, South Africa Cape Province, dense human population. (7) Northern Coniferous Forest (in D climates) – boreal forest, taiga, needle-leaf trees, some adaptation to freezing and waterlogged soils. (8) Tundra – frozen soils, no trees, but instead sedges, mosses, lichens, dwarf trees in some places, xeriphytic adaptations.

Unit 26

Zoogeography, animal range, habitat, ecological niche, natural selection, mutations, von Humboldt and Darwin and Alfred Russel Wallace, Wallace's Line, Zoogeographic realms. Ecological zoogeography, island biogeography, island size vs. number of species, balance of between arrivals of new species and extinctions of those already present, island biogeography and conservation efforts.

Unit 27

Earth's interior, evidence of denser materials nearer the earth's center, earthquakes and seismic waves, speed of waves and material density, mapping interior structure with seismic waves. Inner Core (solid, iron+nickel, 760 miles thick), Outer Core (liquid, nickel & iron, 1400 miles thick, earth's magnetic field), Lower Mantle (solid, iron, magnesium, silicon, 1385 miles thick),

Upper Mantle (solid, 415 miles thick, lower portion is mostly solid but 'plastic', upper part is more rigid), Mohorovicic discontinuity (Moho) – significant density and composition change, Earth's crust – oceanic (~5 miles thick) vs. continental (~ 25 miles average thickness). Felsic vs. Mafic rocks. Lithosphere (crust + uppermost rigid part of the mantle) vs. the asthenosphere – but boundary is not abrupt. Lithospheric plates, the crustal surface, patterns and reasons for topographic relief, high vs. low relief. Continental shields vs. orogenic belts, cratons. Shield examples: Canadian Shield, Guyana Shield, Brazilian Shield, African Shield, Scandinavian, Siberian, Indian Shield, Australian, Antarctic Shields. Orogenies, examples such as Appalchians, Sierra Nevada, Andes, Alps, Himalayas. Weathering and erosion.

Unit 28
Minerals vs. Rocks, Crystalline structure, chemical composition. Mineral types such as silicates (which can include quartz, feldspar) and carbonate minerals. Classification of rock types, igneous rocks, sedimentary rocks, metamorphic rocks, magma, lava, intrusive igneous rocks, extrusive igneous rocks, granite vs. basalt. Intrusive batholiths.

Unit 29
Sedimentary rocks, lithification, compaction and cementation, clastic vs. nonclastic sedimentary rocks. Conglomerates, sandstones, and shales as examples of clastic sedimentary rocks. Limestone as an example that could be clastic, but often is nonclastic. Stratigraphy, importance of unconformities. Metamorphic rocks, metamorphic rock types such as quartzite, marble, slate, gneiss. The Rock Cycle. Introduction to the geologic time scale.

Unit 30
Plates of the lithosphere. Alfred Wegener, Pangaea, continental drift, plate tectonics, seafloor spreading, rifting, lithospheric plates, movement of the plates, things that can happen at plate boundaries such as subduction, earthquake map of the world, divergent vs. convergent plate boundaries, ocean-ocean plate convergence & island arcs, continent-continent plate convergence, ocean-continent plate convergence – example of Cascadia. Transform plate boundaries.

Unit 31
Mechanism of plate motion, isostasy, the linkage between plate tectonics, isostasy, mountain building, and erosion. Ice sheets and isostatic rebound. Evolution of the continents with shields at the centers, and younger terranes added on.

Unit 32
Volcanism and its landforms. Distribution of volcanic activity, Pacific Ring of Fire, Hotspots, Spreading centers and subduction zones, active, dormant, and extinct volcanoes. Properties of magma, viscosity and gasses, pyroclastics, flood basalts. Landforms such as calderas, composite volcanoes [lahars, pyroclastic flows], cinder cones, shield volcanoes [Aa vs. pahoehoe], basalt plateaus and plains, hot spots. Modern society and volcanic hazards.

Unit 35
Geomorphology; Processes that shape landforms: weathering, erosion, mass movement, action of running water, glaciers, wind, coastal waves and currents, sediment deposition. Gravity, slopes, and relief. Erosion and tectonics; measuring erosion and deposition; Regional landscapes.

Unit 36
Weathering. Chemical and mechanical, artificial structures and natural materials, formation of soils. Mechanical Weathering; frost action, salt crystal growth in arid and coastal areas, exfoliation in granitic rocks, thermal expansion and contraction. Chemical Weathering and importance of water; spheroidal weathering in granite, processes such as Carbonation ($CO_2 + H_2O \rightarrow H_2CO_3$ Carbonic acid) of calcium carbonate, hydrolosis and silicate mineral weathering (separation of H_2O into hydroxide ions and then reaction with Mg Oxides to yield Mg ions and silicic acid (H_4SO_4); oxidation (reaction of iron minerals with O_2 to produce iron oxides, products of weathering such as clay minerals. Biological Weathering. Physical and chemical effects of weathering on landforms. Geography of weathering.

Unit 37
Mass Movements; hazards from mass movements, their importance in shaping landscapes, force of gravity and importance of friction, frictional strength, geometry of materials, cohesion. Forms of mass movement; differentiation by water amounts and speed, Creep (not really a "failure" and solifluction (freeze and thaw, slow wave-like movements on slopes), Slides – examples such as (rotational) slumps, rockslides, Flows such as slow earthflows vs. debris flows, Falls. Human alteration on mass movement processes.

Unit 38
Hydraulic civilizations, Surface parts of the hydrologic cycle, interception, infiltration, infiltration rate, effects of humans, runoff, snow vs. rain, water flow in streams: slope, vertical profile of velocity, resistance to flow, helicoidal flow. Discharge, $Q=VA$, hydrograph, groundwater, vadose vs. saturated zone, water table, aquifers, aquicludes, groundwater discharge, springs, perched water table, groundwater recharge, hydrothermal water, traditional wells, artesian wells, drawdown, cone of depression, groundwater pollution

Unit 39
Fluvial processes, infiltration capacity, rainsplash erosion, sheet erosion, rills and gullies, stream networks, drainage basins/watersheds, drainage divides, sediment yield, alluvium. The work of streams, deltas, floods. Erosion through hydraulic action, abrasion, corrosion. Transportation through bedload, suspended load, dissolved load. Deposition/aggradation, importance of base level, stream incision. We are skipping the parts of the unit on stream power, energy and work in stream systems, and the concept of the graded river system.

Unit 40 (Only a Small Part)
Landscapes shaped by fluvial erosion. Dendritic drainage vs. others such as radial or rectangular

Unit 41
Landforms of the fluvial system. Alluvial fans (ephemeral streams, fans, bajadas). Landforms of River Valleys (alluvium, meanders, point bars, cutbanks, oxbow lakes, braided streams). The Floodplain (floodplains, meander belts, floodplain use by humans). Terraces. Deltas.

Unit 43
Cryosphere, glaciers (alpine and continental), glacial periods/ice ages, interglacials, formation of glacier ice, firn, zone of accumulation, zone of ablation, movement of ice, glacial creep, glacial sliding, temperature and glacial movement, glacial erosion/plucking/abrasion/striations

Unit 44
Continental glaciation, Antarctic ice sheet, Greenland ice sheet, past ice sheets such as the Laurentide and Cordilleran Ice Sheet, fluctuations of the Laurentide Ice Sheet such as the Wisconsinan and earlier periods, glacial sediment such as till, outwash, landforms such as moraines, terminal moraines, recessional moraines, drumlins