MOUNTAIN GEOGRAPHY MIDTERM STUDY TOPICS

Chapter 1: An Introduction to Mountains

The Importance of Mountains

Water supply, hydropower, forests, minerals, hotspots of diversity, sanctuaries for rare biota, high levels of endemic species, functioning as biological corridors, original sources for most major food staples, location of high numbers of medicinal and food plants, home to many indigenous peoples, high physical and cultural diversity drives high levels of mountain tourism, spiritual, cultural, and sacred significance, location of serious and extensive hazards, "experiments" in sustainability

Defining Mountains

Mountains have a summit, but what other attributes define a mountain? Roderick Peattie: (1) mountains should be impressive, (2) they should enter into the imagination of the people who live within their shadow, (3) they should have individuality, problems with the Peattie definitions? Alternative "objective" criteria, problems with using elevation, local relief, dissected landscapes, geologic criteria, construction vs. erosion, climatic & vegetation characteristics, uses of definitions for international funds and efforts, binding definitions are elusive

Mountain Challenges and Opportunities

Mountain peoples are typically independent, innovative, resourceful, adaptive, and outstanding entrepreneurs. At the same time, they include some of the poorest, most remote, and disadvantaged people in the world. High elevations and cold climate limit highly productive agriculture and limits animal husbandry. Poverty, access to education, health, and resources is difficult, there is often a major inequity between lowlands and uplands. There is a long history of bad relations between mtn peoples, central governments, and outsiders. More than half of the current wars/conflicts involve mountain peoples. Challenges with high magnitude/frequency of natural hazards. Potential for important local production of alternative energy, relationship with chronic wood shortages. Significant health issues in high altitudes such as acute mtn sickness and air quality. Out-migration of skilled labor forces (Appalachians, Hindu Kush), Dynamic physical environments, extremely fragile ecosystems, impacts of climate change (habitat shifts, hazards changes, snow tourism). Global awareness of mtns, protection, ecosystem services.

Chapter 2: Origins of Mountains

Basic components of plate tectonics and evidence for these components and processes; relation of some or most mountains to tectonics processes.

Characteristics of Major Mountain Ranges

Distribution of major mtn ranges compared with earthquakes, volcanism, ocean trenches, island arcs; ages of continental materials, shields/cratons/coastal areas; composition of most great mountain ranges (marine sedimentary, though added to and altered); isostasy, isostatic depression and rebound; relationship between orogenesis and mountain forms, maximum mtn height, pressure and melting at mtn range bases affecting forms, glacial buzzsaw hypothesis; thickness of the earth's crust on average vs. that below mountain ranges; accumulation in sedimentary basins as the source material for many great mount ranges; passive vs. active continental margins; accretionary wedges

Theories of Mountain Origin

Pre-tectonics ideas such as geosynclinals theories, continental drift; Introduction to Plate tectonics: what are plates? What moves them? Hot spots; sea-floor spreading; lithosphere/asthenosphere; mid-ocean ridges; deep-sea trenches (and associated sea floor age); convergent vs. divergent plate boundaries, subduction; relationship between earthquakes and subduction; postulated mechanisms including ridge-push, slab-pull, slab-suction; The subduction zone: trench, accretionary wedge, Forearc basin, volcanic arc or belt

Mountain Building and Plate Tectonics

Ocean-ocean convergence, ocean-continent convergence, continent-continent convergence; divergence, rift zones, host & graben landscapes, formation of passive margin plateaus; transform plate boundaries; Arcs such as Aleutian-type arcs and Andean-type mountain belts; examples of continent-continent collisions (Alps, Himalaya, early Appalachians); erosional mountains; how erosion and sometimes cause higher rates of uplift, effect of prevailing weather on mtn. evolution, erosional relict/residual mountains (Uluru, Half Dome)

Principle Mountain Types

Volcanic mountains: cinder cone/shield volcanos, composite cones; faulted and folded mountains; various types of folded mountain structures and domes; smaller features due to differential weathering or topographic inversion

Chapter 3: Mountain Climate

The effects of climates are most evident at climate margins (deserts and tundra); great climate diversity over short distances due to complex relationships between topography, energy, and moisture fluxes; usually temps decrease with elevation, cloudiness and precip increase with elevation, it is usually windier in mtns, air is thinner and cleaner, the sun's rays are more intense in mountains

External Climatic Controls

Latitude: sun angle, day length, solar radiation, midlatitude summers very high temps & mtns get high solar intensity, latitude can be partly compensated for by slope angle and orientation, global pressure and wind belts; ***Altitude:*** systematic changes with increasing altitude, temps, air density, water vapor, CO2, impurities, reasons for these systematic trends due to atm heating coming from the ground, mountain mass effect, atm density and composition affect its ability to hold heat; half of all water vapor is below 1800m, diminishing rapidly and barely detectable above 12000m; herders in the Tien Shan and the Pamirs often take their flocks higher in the winter than in the summer to take advantage of lower snowfall and sunnier conditions at higher elevs; mtns lower the horizon at high elevs, but raise them for the lower surrounding areas; ***Continentality:*** Affects moisture regimes, can be enhanced by mtn barrier effects, comparison of Cascades to the Himalaya; ***Barrier Effects:*** Damming, deflection and funneling, blocking and disturbance of the upper air and regional atm, forced ascent, forced descent

Major Climatic Elements

Solar Radiation: mtns have most extreme and variable radiation climate on earth, attenuation of shortwave solar energy at lower elevs, UV radiation, stratospheric ozone, Von Humboldt and blue light scattering, effect of clouds/mtns on solar energy dynamics, difference in UV radiation with elevation and its effects on tundra plant growth, cancer, eye damage, effects of slopes on radiation, effects on snow and evaporation, north vs. south-facing slopes and orientation of villages in the Alps (for example), east-west differences due to moisture and diurnal heating, daily cycles for clouds, effects of surface characteristics such as snow, ice, pastures, forests, bedrock (albedo, holding of heat), effects on local wind systems***; Temperature:*** Temperature change with altitude, environmental lapse rate, valleys have more extreme range than do ridges, mountain mass effect, temperature inversions, mid-elevation thermal belt, temperature range in tropical vs. arctic mountains; ***Humidity & Evaporation:*** most important component of atm in regards to weather and climate, greatly modifies energy budgets, buffers extreme temps, important biologically, absolute humidity decreases with increasing altitude, but highly variable, water vapor and precipitation are not directly related to one another, many high-elevation plants show desert adaptations, importance of dessication at high elevs (dried meat dishes common, food preservation, mummification of the dead), remaining questions about whether evaporation increases with altitude; ***Precipitation:*** increasing precip with elevation (Orographic effect), but this often has a maximum height, and funneling can alter the basic vertical position, relationship between orographic and rain shadow effects; ***Winds:*** Among windiest places on earth, usually greatest in mtns oriented perpendicular to prevailing winds, wind speed double or triples in the first few meters, importance of wind stress on microhabitats, redistribution of snow by wind, local wind systems in mountains, Foehn winds and Bora winds caused by barrier effects.

Microclimates

Large differences within meters or even centimeters, forces plants and animals to a high degree of specialization and adaptation; plants can sometimes make their own microclimates (like by letting snow), these microclimates are currently almost unmappable and unmeasureable.

Climate Change and Variability

Extremes are of greater frequency and magnitude in mtn environments over historic records; (1) number of extremely warm summer temp days has increased, (2) number of extremely cold winter temp days has decreased, (3) mean summer precipitation has increased. Importance of snow melt changes in the Southern Rockies and the Cascades, for example; are these changes due to recovery from the Little Ice Age, or due to anthropogenic greenhouse gas increases; mtns as global barometers.

Chapter 4: Snow, Ice, Avalanches, and Glaciers

Snow & Ice

Snowfall & New Snow: formation of ice crystals & snow, condensation nuclei, crystal growth, different kinds of snow and snow metamorphism, firn; ***Mtn Snowpack as a Water Resource:*** snow water equivalent, seasonal storage, measurement, snowmelt monitoring and modeling, snow augmentation; ***"Permanent" Snow and the Snowline:*** terminology confusion of the word "snowline" (climatic, annual, etc.), summer maximum meting elevation, importance of regional snowline.

Snow Avalanches

Historical importance of avalanches, Strabo, over 10,000 soldiers killed in one day (WWI), issues in US mining towns, modern recreational deaths; types of avalanches including loose-snow avalanches vs. slab-avalanches and how they're different; factors including starting zones, fracture line, favored terrain, unstable snowpack, a trigger, stability testing; forecasting and mitigation including avoidance, monitoring, forecasting, avalanche centers, active mitigation.

Glaciers

Definition of a glacier, origin of glacial ice, its density, and plastic (ductile) flow; ***Types of Glaciers:*** alpine vs. continental, cirque vs. valley glaciers, ice caps; ***Glacial Climatic Response and Mass Balance:*** Concept of mass balance, Pleistocene glaciation, accumulation vs. ablation, equilibrium line altitude, widespread recent global alpine glacier retreat, climatic glacial fluctuations, Little Ice Age, Milancovic Cycles; ***Glacier Thermodynamics and Hydrology:*** cold-based vs. warm-based glaciers, englacial/subglacial/supraglacial water flow, internal deformation vs. basal sliding, flow velocity; ***Structures within Glacial Ice:*** Crevasses, moraines***; Glaciers as Landform-forming Tools:*** abrasion, crushing, plucking/quarrying, rouche moutonees, transport of debris by the ice and by glaciofluvial systems, drift, till, outwash, erratics; ***Glaciated Mtn Landscapes:*** high ruggedness, cirques, horns, arêtes, tarns, hanging valleys, U-shaped valleys, glacial buzzsaw hypothesis (again), fjords, outwash plain, rock glaciers; glacial outburst floods

Chapter 5: Mountain Landforms and Geomorphic Processes

"Old" vs. "New" mountains, effect of relief on denudation rates, mechanical denudation vs. chemical denudation, rate and type of geomorphic processes in mtns greatly affectd by form, structure, composition of mountains, orogeny can sometimes outpace erosion, in which case structure can be directly manifest, measurements of uplift can be achieved with GPS, dated uplifted sea level features, dating of minerals that form at known depths, importance of rock type to erosion rates and processes (massive crystalline vs. soft sedimentary, for example)

Landscape Development

Ideas of William Morris Davis (strongly timebound) vs. those of the mid-20th century (strongly timeless), where we stand today on the timebound/timeless question for different mountain ranges, overall shapes of slopes: relationship of hillslope process and water/runoff processes