Uinta Mountains Field Trip Resource Guide

PURPOSE:
(a) To learn some of the diverse natural history of northern Utah.
(b) To be introduced to plant ecology including plant identification, community distribution, and influence of humans and environmental factors upon natural vegetation.
(c) To assess the management of land by public agencies on a multiple-use basis.
(d) To have an opportunity to see large-scale water projects and their effects upon an arid environment and its people.
(e) To become aware of the delicate balance between natural resource exploitation and preservation and everyone's responsibility in learning of the diversity of values which must be considered before making decisions which affect such resources.
(f) To both understand and appreciate the diversity of esthetic qualities provided by our Utah environment.
(g) To have fun doing the above.

I. Orientation at Weber State University campus.

A. Wasatch Mountains east of the campus extend northward to the Utah-Idaho border and southward to Mt. Nebo in Juab County.

B. Westward is the Valley of the Great Salt Lake, a portion of the Great Basin (named by John C. Fremont - the first to make any scientific plant collections from Utah) which extends westward to the Sierra Nevada in California. This Great Basin covers 200,000 square miles and has no drainage to the ocean.

C. The Wasatch fault runs N-S through the WSU campus. The Wasatch Mountains were initially lifted upward by mountain-building activities approximately 60 million years ago.

D. The Great Salt Lake is presently at approximately 4210 feet elevation. Since pioneer times the lake has varied between 4190 and 4212 feet elevation. During the Ice Ages and afterward a huge lake, Lake Bonneville, the size of present Lake Michigan, extended over this part of the Great Basin. Its surface was approximately 1000 feet higher than the present Great Salt Lake. Terraces of this prehistoric lake are evident along the western edge of the Wasatch Mountains and on other mountain ranges of the Great Basin. The WSU campus is on one of these ancient terraces, the Provo level. Conspicuous on the mountainside above the campus is a prominent terrace, the Bonneville level. During the last part of the Ice Age, approximately 18,000-25,000 years ago, the climate was very cold and wet. Geologists have found evidences that the shoreline vegetation of that time consisted of a forest of subalpine fir and Engelmann spruce. Such forests are now located just below timberline on the Wasatch and Uinta Mountains of Utah. Ogden Valley, Morgan Valley, and Cache Valley were bays of this ancient Lake Bonneville. Huge deltas extended into this ancient lake at the entrances of present Ogden and Weber canyons. After the lake level lowered to its present position stream erosion has carved the two canyons deeper and has removed large portions of those ancient deltas as the Ogden and Weber Rivers extend westward to join together and then

empty into the Great Salt Lake.

E. Vegetation: In Utah we find considerable variation in vegetation due to diversity in: (1) soil type, (2) elevation, (3) aspect, (4) temperature (both macro- and micro-), (5) precipitation, and (6) last but not least - past uses of the land.
Variations are found in both composition and density.

(i) PRISTINE VEGETATION

Just prior to intensive settlement, the vegetation was dominated by scrub oak foothills merging into lower slopes and valleys which were primarily covered by perennial grasses with some interspersed sagebrush. Relatively few juniper trees were found in the foothills below the clumps of scrub oak. The lower foothills and valley floors were green in springtime, however, during the drought of late summer, these grasses turned brown. The climate was arid with most of the precipitation coming as snow in the winter season as it is now. Under these circumstances, no large trees could be supported except for the cottonwoods and willows that grew along the rivers and streams (these trees are called phreatophytes).

(ii) PRESENT VEGETATION

Settlement by the pioneers in the 1840's brought irrigation for introduced crop plants. These plants were introduced from many parts of the world especially Europe and included trees and shrubs as well as crop plants. Presently the valley is much more treed than before. Many areas of native grasses were overgrazed and several native plants, less desirable for grazing, increased their range. At the same time, exotic species were both intentionally and unintentionally introduced and then became pests or weeds of fields, gardens, and rangelands.

II. The Physiographic Provinces of Utah

A. Basin and Range Physiographic Province: of which the Great Basin is a portion, is an elevated plateau-land approximately 4000 feet in elevation, characterized by north-south trending desert mountain ranges separated by broad desert valleys. The Great Basin was named by Captain John C. Fremont as part of the "Great American Desert". We begin our field trip in this province, but we leave it as soon as we enter Weber Canyon.

B. Middle Rocky Mountain Physiographic Province: consists (in our area) of the Wasatch and Uinta Mountains. This area is characterized by extensive mountain areas of complex structure, separated by narrow valleys which have been modified extensively by stream erosion and fault action. Nearly all of our field trip is in this province.

C. Colorado Plateaus Physiographic Province: includes the mountainous portions of the central and eastern parts of the state (southward from the Wasatch and Uinta Mountains) and the desert canyonlands between them. Our field trip does not enter this province.

III. Weber Canyon

A. The steep-sided V-shaped valley through which the Weber River flows is a good example of a stream-cut canyon. Lake Bonneville once buried the bottom of this canyon, extending eastward as far as the town of Morgan.
B. At Devil's Gate in the canyon the river makes a sharp gooseneck turn to the north of today's modern freeway. This portion of the canyon was a pronounced barrier to a group of California-bound pioneers, who brought 66 wagons through here in 1846. Each wagon had to be dismantled and lowered down the mountainside by windlass and rope. These pioneers exerted much effort and were delayed in their journey to California along the so-called "Hastings Cutoff" from the Oregon Trail.

C. Across the river from the freeway exit to Mountain Green is the intake of the Davis-Weber Canal tunnel through the mountain. We'll refer to this structure later on our field trip.

D. Presently a new highway has been constructed from Mountain Green to Huntsville, called the "Trapper's Loop Highway". This highway provides an alternate entrance to Ogden Valley to the present Ogden Canyon and North Ogden Pass highways. The new highway makes the recreational areas of Ogden Valley easily accessible to the residents of Davis and Salt Lake Counties. Keep this in mind as you think of the destination resort development at Snow Basin.

IV. Morgan

A. This town is at an elevation of 5063 feet. It is the county seat of Morgan County. It was first called Monday Town, but was renamed in honor of Jedediah Morgan Grant.

B. Morgan has been an important railroad stop, a center of farming and ranching, and a recreational area. Morgan valley is facing the challenge of development into extensive housing and recreational areas.

V. Devil's Slide

A. Devil's Slide was formed in the following way. Horizontal beds of sedimentary materials were uplifted and turned into a vertical position. The two prominent beds that are 20 feet apart and 40 feet high are made of limestone while the layer between them is made of shale which decomposed more rapidly.

B. The "Twin Creek" limestone formation is utilized along with "Ankareh" shale for manufacture of cement at a "plant" (notice how we designate locations of manufacturing a PLANT) located northward from the freeway. The cement company installed equipment to remove most of the dust, which caused considerable air pollution in the 1960's and early 1970's.

VI. Pre-settlement history of this general area.

A. In 1825 General William H. Ashley and Major Andrew Henry, founders of the Rocky Mountain Fur Company, came through this part of Utah exploring the Wasatch and Uinta Mountains. James Bridger, Jedediah Smith, and Kit Carson were with them. Each of these men contributed to the exploration of the west.

B. A Canadian based Hudson Bay Fur Company was represented in the area by Peter Skeen Ogden. Later Ogden River, Ogden Valley, and the city of Ogden were named after him. (As far as we know, Peter Skeen Ogden did not come to the present site of Ogden city).

C. Representatives of the two above-named fur companies met at Mountain Green to decide which company would gain the upper hand in seeking fur-bearing mammals in the Wasatch Mountains. The Rocky Mountain Fur Company leaders forcefully recruited most of the men who were formerly employed by Peter Skeen Ogden and required him to retreat over "Trapper's Loop" to the Cache Valley region, leaving them in control of the Uinta Mountains and this portion of the Wasatch Mountains.

VII. Pioneer history.

A. The Hastings party of California-bound pioneers came through this valley in midsummer of 1846. They traveled from Echo through Weber Canyon, then southward around the southern end of the Great Salt Lake, before crossing the salt flats and traveling on to the Humboldt River in Nevada.

B. The Donner party came later in 1846. They were trying to overtake and join the Hastings party, but failed to do so. Instead of following them through Weber Canyon the Donner party built the wagon road from Henefer westward past present East Canyon reservoir, over Big Mountain pass, down into Parley's Canyon, over Little Mountain pass into Emigration Canyon, and thus into the Salt Lake Valley. The road construction required nearly three weeks of valuable time. This is the route of Brigham Young and the Mormon pioneer expedition of 1847. The building of this wagon road through the mountains was one of several delays for the ill-fated Donner party, which met disaster from heavy and early snows in the Sierra Nevada before they could reach their destination of Sacramento. The Donner party made many unfortunate decisions along the way, and many of the survivors resorted to cannibalism when caught in the heavy winter snows of the Sierra. Most of them did not survive the ordeal.

C. The Mormon pioneers of 1847 arrived in the Salt Lake Valley in time to raise some crops and prepare shelter for the coming winter; and were fortunate to have a mild weather during the first winter in the valley.

VIII. Water Development in modern times

A. The success of our civilization in the desert climate of Utah is dependent upon the wise use of

water resources. During the 20th Century the federal agency that has led the way in water development was the Bureau of Reclamation. Established by the Congress in 1902 and part of the Department of Interior, this agency helps settle large-scale problems of water rights; constructs dams for impoundment of run-off water in reservoirs for use during growing seasons; distributes water through a system of canals, pipelines, and tunnels; encourages settlement of irrigated lands; and aids in flood prevention. Some of the very large projects of the Bureau of Reclamation include the Grand Coulee Dam on the Columbia River, the Shasta Dam on the Sacramento River, and the Hoover Dam on the Colorado River.

B. The Weber Basin Project, authorized by the Congress in 1949, serves much of the water needs of Weber, Davis, and Morgan counties and portions of Box Elder County. Construction of units of the project did not begin until 1956. Total cost of the project was $97.5 million, of which water-users will repay $81 million to the federal government during the first century. The balance is charged to recreational and wildlife users. Irrigation, municipal, and industrial uses are made of the water itself. An important feature of the project is flood control, as provided by water-storage upstream from populated areas, during times when the reservoirs are not filled to capacity. Dams that are included in the Weber Basin Project include: Lost Creek, Rockport, East Canyon, Causey, Pine View, and Willard. East Canyon and Pine View dams were constructed before the project began, and were made higher in order to store much more water than before. The other dams were constructed anew. In addition to water-storage reservoir dams the project includes canals, diversion dams, tunnels, aqueducts, and 24 small reservoirs to control water pressure in distributive pipelines.

C. Echo Dam is not part of the Weber Basin Project; its construction preceded such and the water stored therein belongs to farmers in Davis and Weber counties organized into the Weber Water Users Association. The dam was constructed in 1931 at a cost of $2.5 million. The reservoir impounds 74,000 acre feet of water. The dam is 155 feet high and 1887 feet long. It is anchored on each end in bedrock. The freeway construction around the dam, built in the early 1970's, involved massive road cuts and fill. Extensive damage has occurred since due to land slippage and gully erosion on the steep mountainside. Massive amounts of material from above the freeway has ended up on the upper portion of the freeway in addition to portions of the freeway slipping downhill. Repair of the damage so far has cost millions of dollars. Solution to the problem may involve diversion of water run-off and seeding of bare areas to prevent further land slippage.

D. Recreational development has occurred at many of these water-storage reservoirs, as supervised by the U.S. Forest Service, or the Utah State Park system.

IX. Continuation of the presentation of Utah's natural vegetation.

A. Utah's climate of cold winters and hot dry summers presents a great challenge to growing plants. The lower valleys were primarily covered by perennial grasses, as discussed earlier. This vegetation type was favored by frequent natural fires (set by lightning or by Indians). The introduction of numerous livestock by the pioneers and the gradual adoption of rigid fire control measures have caused a change of vegetational cover from perennial grasses in the valleys and foothills to more abundant sagebrush and juniper trees. Both sagebrush and junipers have shallow and extensive root

systems, which crowd other plants, as these woody plants utilize nearly all of the soil moisture available. Both sagebrush and junipers need well-drained soil, and can't get established in salty or alkaline soils. Juniper forests have increased over 7 times their original area covered in Utah in 140 years of land management, primarily as a result of over-grazing by livestock.

B. Zonation of vegetation:

1. The largest portion of the state of Utah, at 4,000 to 7,000 feet elevation is the desert shrub and foothill forest of pinion-juniper zone. In addition to sagebrush and Utah Juniper on well-drained areas, it includes shadscale, greasewood, and other types of shrubs on poorly drained and often salty or alkaline soils. This Life Zone is called the Upper Sonoran Life Zone.
2. A transitional zone of mountain brushland or chaparral is found at higher elevations than 7,000 feet, consisting of scrub oak, big-tooth maple, Mt. mahogany, serviceberry, and chokecherry. In the Uinta Mountains this zone also contains Ponderosa Pine and Rocky Mountain Juniper trees. The Ponderosa Pine forests of Utah are not extensive enough and trees not large enough to supply much lumber. Forests in Utah provide watershed, cover for wildlife, and overstory for other types of vegetation. It is not surprising that this Life Zone is called the Transition Life Zone.
3. The main forest belt (called the Canadian Life Zone) of our mountains, the montane forest is typified by White Fir, Blue Spruce, and Quaking Aspen trees. Other trees such as Douglas Fir and trees from lower and upper forest zones may occur here also.
4. The timberline forest of Subalpine Fir and Engelmann Spruce is located just above the montane of our mountains. It is often referred to as the Hudsonian Life Zone. In the Uinta Mountains this forest belt also includes the Lodgepole Pine. This tree is not found in other parts of the state of Utah.
5. The treeless vegetation above timberline on our highest mountain peaks is referred to as the Alpine Life Zone. The Alpine Zone has a latitudinal counterpart in the Arctic Tundra. Both consist mostly of herbaceous plants, such as sedges, grasses, broad-leaved flowering plants, and a few small woody shrubs, which do not get higher than the depth of insulating snows.

X. Rhodes Valley: from Peoa and Oakley to Kamas.

A. Mormon pioneers, led by a Thomas Rhodes settled this area in 1957.

B. Growing seasons are short and crops are mainly grains, hay, and pasturelands. Winters are more severe and summers are generally cooler than along the Wasatch Front.

C. A diversion canal runs across Rhodes valley from the Weber River above Oakley, taking excess water from this watershed past Kamas to the Provo River.

XI. Samak (Kamas spelled backward)

A. A development of summer homes east of Kamas along Beaver Creek.

B. This private development is adjacent to national forest land and may eventually become crowded

with 3000 homes. Summit County has few zoning restrictions, and consequently house construction varies from the tin shack with an outhouse nearby to a mansion with modern septic tanks and drainage fields. Eventually however, the sewage or the effluent from drainage fields end up in Beaver Creek, inasmuch as this part of Summit County has no sewage disposal system. Water pollution problems in Beaver Creek are already severe. Other problems of the area are: need for fire protection, air pollution from fireplace smoke, noise pollution from congestion in such a crowded area, encroachment onto forest lands for firewood without permits; and interference with deer winter range.

XII. Mirror Lake Multiple Use Highway from Kamas to Mirror Lake

A. The Multiple Use-Sustained Yield Act of Congress of 1960 lists five major renewable resources for national forest lands. Timber, forage for livestock, water, wildlife habitat, and recreation are administered on an interrelated basis by the U.S. Forest Service.

B. The philosophy of management is "the greatest good for the greatest number of people".

C. A renewable resource is one in which the supply may be replenished year after for many generations of people.

D. The Kamas Ranger District is one of only four districts in the entire nation selected by the Forest Service as multiple-use demonstration and pilot study site.

E. The Mirror Lake Multiple Use Highway was completed in 1960 from Kamas, Utah, to Evanston, Wyoming. This recreation area is 75 miles from Utah's major population centers, and provides picnicking, camping, hiking, fishing, hunting, and other uses for hundreds of thousands of visitor-use days. As our society develops more leisure time and affluence much greater pressure will be evident on these and other limited recreational areas of our national forests and parks.

XIII. Natural Arboretum

A. The Forest Service has designated this highway as a natural arboretum. Almost all of the native trees of Utah are located in this one area. The Forest Service plans to identify and sign many of the trees and other plants so that visitors to the area may identify them.

B. The following tree species have been identified, but not signed as yet: Utah Juniper, Pinion, Ponderosa Pine, Rocky Mountain Juniper, White Fir, Blue Spruce, Limber Pine, Lodgepole Pine, Douglas Fir, Subalpine Fir, Engelmann Spruce, Quaking Aspen, Narrow-leaf Cottonwood, Rocky Mountain Maple, Bigtooth Maple, Alder, and Birch.

XIV. Multiple-Use Management

The forest is a complex resource consisting of soils, water, trees, shrubs, grasses, and many other plants and animals that live there. Since it so complex, the forest can have many uses. In the Multiple-Use Act of 1960, five major uses were outline: timber, grazing, recreation, wildlife habitat, and watershed. The forester is required to consider all of these uses in management planning. Often two or more of the uses can be complementary but in other cases they conflict. Therefore, it can become difficult to manage for all of the possible uses. As examples: (1) grazing and timber harvesting is usually not allowed in a developed recreation site (campground), (2) a timber harvest can be beneficial for wildlife or harmful depending on how it is accomplished, (3) grazing can be harmful to the watershed, (4) actions that improve the watershed can improve wildlife habitat, and (5) timber harvesting usually improves grazing.

XV. Wildlife

A. Kamas Ranger District has a deer herd of approximately 7,000 population. Winter feed is nearly all browse: mountain mahogany, bitterbrush, juniper, scrub oak, etc. on the foothills. Summer feed is on the higher mountainsides, mainly woody vegetation. Each year the "harvest" from this deer herd is approximately 2,500 head. The size of the deer herd will probably have to be cut down in size as the habitat becomes damaged by over-population. A disturbing factor, as far as the wildlife managers and sportsmen is concerned, is the encroachment of permanent housing, summer homes, and other recreational activities on deer winter range areas.

B. Many other kinds of wildlife are found in the area, including elk and moose among big game animals. Elk are primarily grazing mammals, in contrast to deer, and compete more directly with domestic livestock on the range. Moose have moved into the Uinta Mountains on their own during the past few decades. They are not native animals to Utah (that is, found in the state in pre-historic times). Populations of both of these big game animals are controlled by hunting, as regulated by a Big Game Board and administered by the Utah Division of Wildlife Resources.

C. Black bear, cougar, coyote, fox, bobcat, badger, martin, mink, weasel, skunk, and rockchuck are some of the other forms of wildlife present in the area.

XVI. Livestock Management

Four cattle and five sheep allotments on the Kamas Ranger District allow for 1500 cattle and 4,600 sheep to graze during the summer season. Cattle like to stay at the bottom of the valley and must be restricted from the highway-river-campground areas by drift fences during the height of the recreational-use season of the year. In the fall after schools open and recreational use diminishes the cattle are allowed to graze the recreational corridor. Before the onset of the deer hunt the cattle are rounded up and taken off the national forest range.

XVII. High Uintas Primitive Area (Wasatch & Ashley Natl. Forests)

A. The High Uintas Primitive Area was established on April 27, 1931 under L-20 regulations of the Secretary of Agriculture. The initial purpose was: "to prevent the unnecessary elimination or impairment of unique natural values and to conserve so far as controlling economic conditions will permit, the opportunity to the public to observe the conditions which existed in the pioneer phases of the Nation's development.....and [for] promoting a true understanding of historical phases of national progress."

B. In 1969, 322,998 acres was proposed as wilderness by the President to Congress.

C. The Uinta Mts. are unique: (1) They contain Utah's highest mountain range; (2) They are the most prominent east-west range in the U.S.A.

D. This range was named after the "Uintas" Indians who were mountain dwellers and a branch of the Ute tribe.

E. Elevations vary from 8,000 feet in the lower canyons and valleys to 13,528 feet at the summit of King's Peak - the highest in Utah.

F. Geologically, the High Uintas are comprised principally of pre-Cambrian, metamorphosed sandstones and conglomerates. Many of the formations are red in color and very spectacular. It is a favorite for backpackers, and campers. In 1936, 410 people visited the area; in 1972, 119,700 visitor days were estimated.

G. An average annual precipitation of 40 inches occurs mostly as snow. The growing season is short and freezing can occur during any month of the year. Afternoon rainstorms are common during the summer months.

H. 32% of the area is forested (coniferous trees - lodgepole pine, Englemann spruce, Douglas-fir, subalpine fir, limber pine, white fir).**I.** Over 50% of the area is barren rock with little vegetation while meadows and grasslands make up 8%. Grazing by domestic livestock is permitted though the forage is poor. The area provides summer grazing for elk, mule deer, moose, and some mountain sheep. Competition for forage between wildlife, cattle, sheep and recreation pack and saddle stock exists in many areas.

J. There are over 500 lakes (approx. 3,000 acres) in the proposed wilderness area, with over 250 capable of supporting fish. Principal species are native cutthroat, Eastern brook, rainbow, and German brown trout. California and arctic grayling are found in a few lakes.

XVIII. Autumn Leaf Coloration

A. Leaf Pigments
The dominant color of tree leaves in spring and summer is green. This color is due to two pigments,

chlorophyll a and chlorophyll b. These pigments are located in plastids and are not water soluble, but will dissolve in organic solvents. Also present in leaves at the same time, but usually not visible due to masking by the chlorophylls, are the carotenoids. Like the chlorophylls, the carotenoids are located in plastids and are soluble in organic solvents, but not in water. These pigments range in color from yellow to orange to red. The orange of carrots and the red of tomatoes are due to carotenoids. Some plants have variegated leaves with a reddish-purple color present with the green. This is seen in variegated *Coleus* plants that are often used in Botany SI2404. The blue to red to purple colors seen in these variegated leaves, plums, and cranberries are due to anthocyanins. These water soluble pigments are located in vacuoles. Except for variegated leaves, the anthocyanins are not present in leaves during spring and summer, while the carotenoids are present.

B. Leaf senescence

The main leaf colors seen in the fall are due to carotenoids and anthocyanins. Two different metabolic events result in the appearance of one of these two pigment groups. As fall approaches, leaves begin to senesce. This is a well described developmental process. Chlorophyll is broken down, and thus the carotenoids become visible. The leaves appear yellow to orange in color. Leaf proteins and carbohydrates are also broken down, and the amino acids and simple sugars are transported to the main body of the plant for winter storage. An abscission zone forms at the base of the petiole to seal off the vascular connection between the leaf and the tree. The leaf drops or abscises. What about the spectacular reds that maple trees made famous? That coloration is due to anthocyanins. These pigments are only made if the leaf is still alive and has a large carbohydrate supply. The best weather conditions to promote anthocyanin synthesis are low (not freezing) night temperatures and bright sunny days. The overall trigger for leaf senescence is increasing night length. The leaves contain yet another pigment, phytochrome, which is responsible for measuring night length.

XIX. Dendrochronology

Each spring the plant ecology class examines cores made with an increment borer (also called a dendrochronometer - what plants ecologists wear around their wrists). The above ground part of the oak that we bore is called a bole (rather than a tree). From these cores we have determined that the larger boles are about 65 years old. Smaller bored boles from higher elevations are also about 65 years old. We will (successfully) demonstrate boring a conifer bole in the field. We may also keep an eye out for natural stumps left by the bipedal chainsaw wielder. In the core of the conifer we note dark, denser bands which alternate with lighter bands - like seven (to many) layer cakes. The unit of one light and one dark (called early/late, or spring/summer) pair is a growth ring. The growth ring shows a years history of that tree in that exact place. Growth of the complex tissue xylem is initiated by the vascular cambium with "bud break" and warming in early spring. Cambial activity ceases in mid summer to early fall. Xylem cells first produced in the spring are relatively large, relatively thin walled tracheids (conifers) or vessel elements and tracheids in angiosperms. (The angiosperms that contribute trees to the forest are nearly all dicots. Some monocots do produce trees but their manoxylic ("punky") wood is produced in a crazy quilt manner and does not result in discernable growth rings.)

The growth rings store much more information than just the age of the individual bole. They reflect the vigor, seasonal climate (especially rain/drought), natural disasters (lightning strikes, fire, bug bite devastations, jeep bumps, viral invasions, and changes in high level administrators in the National Forest Service). The science of dendrochronology statistically correlates tree rings across communities and geographic ranges (how extensive was drought, pestilence, fire over distribution of forests). It provides insights into the different ecological tolerances of different tree species for example, how do early successional species reflect competition later in their lives, what growth rate differences occur in Douglas fir where it is most common and where it is a mid-successional pioneer; how do growth rings of black cherry differ in that part of its range where the fungus Apiosporina morbosa (Dibotryonmorbosum) is ubiquitous as compared to sites where it is absent? Finally the real chronology in dendrochronology results from our recently acquired ability to visually and statistically correlate growth rings of long lived (living) Pinus aristida andSequoia sempervirens with older (R.I.P.) stumps and remnants, recent nearly fossilized pieces, and smaller pieces found in archeological digs. This has provided a record of changes in climate and plant distribution extending back about 7500 years. The recent Pleistocene paleoecology provides our best data base for predicting the near term future changes likely to result from natural and man induced global climatic change.

XX. Plant Succession

Definition: The Process of biotic and abiotic change that ecosystems (like a lake or forest) undergo as they age.

Primary Succession begins on sites devoid of biota, therefore all biota must be imported (example-volcano, rock side, new lake basin).

Secondary Succession begins on sites where biota are present (such as burned areas or forested areas cleared for growing annual grasses).

Most succession is directional, species replacement sequence is repeated on similar sites, and it terminates in a stable combination that is long lasting in comparison to previous species combinations. This relatively long-lived steady-state of community productivity, structure, and populations is referred to as **climax** and involves a dynamic equilibrium between organisms and habitat. Diversity increases as succession proceeds as does the biomass, net primary productivity, nutrients (inorganic and organic), complexity of the food web, and microclimates in the area. It is believed that the climax condition is so well buffered and complex that it is virtually self-perpetuating so long as the climate and other environmental factors remain essentially unchanged. Ecologists believed in the notion that one type of climax only would characterize a given area (monoclimax) while the current thinking suggests that, due to significant variations in important environmental factors, no absolute single climax exists for any given region (polyclimax). The first such studies and conclusions about succession were made in 1863 by a German ecologist (Kerner) who studied the vegetation along the Danube River. In the U.S.A., Henry Cowles in the 1890's pioneered work on the plant succession on sand dunes near Lake Michigan.

Two major types of primary plant succession are recognized based upon the moisture extremes of the habitats in the beginning. A dry extreme, as is found on rock or volcanic ash is one type. A newly created lake basin represents the other moisture extreme. "Father Nature" (must have equal time) does not "like" extreme conditions and through "Mother Time" ameliorates or moderates the extremes. The dry extreme will become moist while the wet extreme will likewise become less wet. Primary succession from dry to moist is called **xerosere** succession while that which goes from wet to moist is called **hydrosere** succession. If environmental conditions will support it, both a rock slide and small lake may become a forest in climax. Each type of succession begins with its own type of pioneer community of plants, which over time, modify the habitat so that other communities may become established. Several such intermediate stages (called seral communities) develop as succession proceeds towards the climax community. While all of this is taking place, the rock or parent material is being weathered (physically, chemically and biologically) into continually smaller pieces and becoming soil components along with dead organisms. Primary succession in the Uinta Mountains in the present-day Hudsonian Life Zone might be diagrammed like this:

Xerosere Primary Succession:
Rock --> Lichens (Pioneer Community) --> Mosses --> Annual Grasses --> Perennial Grasses and Forbes --> Shrubs --> Spruce/Fir (Climax Community)

Hydrosere Primary Succession:
Glacial Lake --> Phytoplankton (Pioneer Community) --> Floating Aquatic Macrophytes --> Water Lilies --> Sedges/Rushes --> Grasses --> Shrubs --> Spruce/Fir (Climax Community)

UINTA MOUNTAINS FIELD TRIP – Review Questions

The following questions may be answered in the various presentations by field trip leaders during the day. The questions are not intended to be all inclusive as to the material presented. As a participant, use the questions for self-assessment of understanding the presentations.

1. List 3 environmental problems facing the "Wasatch Front" portion of Utah.

2. How has the climate of the Great Basin changed during the past ten thousand years?

3. List the projects of the Bureau of Reclamation in the area traversed by the field trip and summarize the value of the Weber Basin Project to northern Utah.

4. What one factor has caused the greatest change in the vegetation of Utah since settlement? Should this change cause us any great concern? What can we do about it?

5. List the major plant indicators for each of the following Life Zones:

a.. Upper Sonoran

b. Transition

c. Canadian

d. Hudsonian

e. Alpine

6. Name 2 (two) native Utah conifers of the Uinta Mountains that are absent in natural distribution from the Wasatch Mountains.

7. Consider the SAMAK summer home area: will there be problems with added development? What are some of the problems created by development in the past?

8. What are the five major areas of responsibility of resource management by the U.S. Forest Service on public land.

9. What problems have developed from the use of Duchesne Tunnel?

10. How is it possible to graze so many animals in the vicinity of the Multiple Use Highway and still have so much recreational use of the highway, campgrounds, and streamside?

11. Describe the types of weathering forces which act on bedrock to break it down into soil particles.

12. How do plants and animals aid in soil development?

13.ln examining an increment core from a given tree, you find that at about 30 years of age the rings narrow for 10 years then get wider. Give two explanations for this pattern for a particular tree.

14. Briefly describe the stages of hydrosere (pond) primary succession as it occurs near Lilly Lake.

15. Review post-glacial xerosere (bare rock) primary succession on upland areas near Lilly Lake.

16. What are some arguments for and against wilderness area designation?

17. Which 2 groups of plant pigments are primarily responsible for the various colors seen in leaves in the fall? What metabolic activities within the leaves lead to the appearance of each of these two pigment groups?