FRIENDS OF TRYON CREEK STATE PARK
11321 S.W. Terwilliger Blvd • Portland, OR 97219 • (503) 636-4398 • www.tryonfriends.org

May 31, 2006

Metro, Greenspaces Grant Coordinator
600 NE Grand Avenue
Portland, OR 97232-2736

Dear Greenspaces Grants Coordinator,

In December of 2005, the Friends of Tryon Creek State Park received a Greenspaces Environmental Education grant to initiate the Ecological Teacher Training Series. Over the past 18 months, we have accomplished many of our goals through creating and implementing this new program focusing on place-based environmental education. At this time we are requesting $4,500 for our final reimbursement. The attached documents will verify our expenses, as well as offer a sampling of the work completed to this point.

Notable accomplishments include:

- Extensive research on curriculum and benchmarks
- Interviews with classroom teachers and non-formal educators
- Observation of existing place-based education programs
- Outreach to teachers across Portland metropolitan area
- Cooperative planning with Lewis and Clark College, NW Regional ESD, Portland State University, and Expeditionary Schools of Outward Bound
- Three teacher trainings planned and facilitated
- Three additional teacher trainings planned for the summer of 2006
- Collaboration with Metro, Portland Parks & Recreation, BES, and Oregon State Parks & Recreation for assistance with training
- Curriculum on field journals and map-making
- 28 teachers attended trainings with Friends of Tryon Creek State Park
- 30 teachers expected for summer trainings coordinated with Friends
- Evaluations distributed and recorded

During the past eighteen months we have successfully held 3 trainings and continued to work with teachers who have attended these trainings. Our research has also provided us with many insights into the most appropriate models for teacher workshops. We have initiated in-depth relationships with our local schools and also collaborated on three summertime workshops with follow-up support throughout the school year. We look forward to continuing to serve teachers in the future. For any questions, contact me at 503-636-4398 or Sheilagh@TryonFriends.org.

Thank you,

Sheilagh Diez
Education Director

Explore • Learn • Protect

Summary of Grant Activities

The Friends of Tryon Creek State Park began the Ecological Teacher Training Series (ETTS) in order to help teachers acquire more skills in implementing environmental education into their classrooms and develop relationships with other teachers concerned with ecological issues. Over the past 18 months we have worked with 28 teachers by developing and leading workshops, working with teachers to implement projects in their schools, introducing them to local resources, and researching applicable curriculum. More than anything, this grant period has allowed us to further research the necessary components to initiate effective, place-based, environmental education programs and to establish relationships with local teachers and schools that will continue to promote place-based education into the future.

Teacher Workshops
Three teacher workshops were planned and presented to teachers. Teachers received direct demonstrations of activities, theoretical explanations, and usable curriculum to bring back to their schools. Teachers were encouraged to communicate their on-going needs to the Friends of Tryon Creek State Park.
Three additional workshops have been planned for the summer of 2006 incorporating research and teacher comments. The first workshop is an intensive place-based education workshop in cooperation with Lewis and Clark College and NW Regional ESD. This workshop is scheduled at the end school when teachers are still focused on curriculum improvement. Participants will receive follow-up support from the Friends and become part of the larger network of place-based environmental educators.
During the second workshop we will be working cooperatively with the Expeditionary Learning Schools program of Outward Bound to prepare two groups of teachers working with existing or planned EL schools in the NW region. The Friends will be providing technical support for on the ground natural science projects as well as guidance for initiating and implementing place-based environmental education in a school setting.
The third workshop will be held in mid-August, just before the teachers return to school. This workshop, held in cooperation with Portland State University, will focus on giving teachers the tools to take their students outside to do field research with an emphasis on protecting urban natural areas.

Teacher Follow-Ups
The program coordinator met personally with ETTS participants to assist them in integrating ideas into their existing curriculum. They also received suggestions for how to work with students in an outdoor setting. Finally, teachers gained material and technical support in establishing projects such as worm bins and bioswales at their schools.
For the last six months, the program coordinator has been establishing a relationship with two local schools within the Tryon Creek Watershed. Teachers at these schools are invited to attend the summer workshops and will receive continued support into the next school year.

Local Resources

During ETTS workshops, teachers were introduced to local resources provided by local non-profits, city and regional government agencies, including material support from Metro educators. Through these connections, teachers were made more aware of existing greenspaces and low-cost program assistance through city agencies. Teachers were also introduced to the Friends of Tryon Creek State Park's Sunday at Two lecture series and adult workshops through which they can gain specific skills to bring back to their classrooms.

The project coordinator has been active in forming a group of educators from around the region working to establish a support network for teachers, formal and non-formal alike, interested in place-based education. After several meetings, a group has been established with the goal to link educators wanting to connect their curriculum to their local community. This support group includes a strategic planning committee, list serve, website, and presentations at statewide conferences with interested participants.

Curriculum Development

Three different sets of curriculum were researched and developed during the 18 month period. Components of nature awareness, map-making, and science inquiry were gathered for these workshop curricula. The program coordinator worked with teachers to understand how the topics best related to their particular classrooms.

Through teacher interviews and extensive research, we discovered that the most effective way to introduce new teaching techniques and curriculum ideas is through a long-term, direct relationship with a school, its principal and its teachers. For this reason, we have established a relationship with two schools within our watershed. By working directly with the principals, we are able to offer support from within as well as outside of the school for the teachers. The teachers will begin to bring in place-based education techniques during the 2006-07 school year. Over the next 5-10 years we will gradually develop these more in-depth relationships with all of the schools in our watershed.

Evaluation of Grant Activities

The funding for the Ecological Teacher Training Series led to several well planned workshops and the beginning of a network of well-connected teachers with similar interests in the ecology and culture of their local place.

During our grant time period, we worked with 28 teachers from across NW Oregon. Participants appreciated the hands-on activities, new ideas, usable curriculum they received, and the chance to meet with other, like-minded teachers. Participants comments included "very well structured", "fun activities and ideas!", enjoyed "making connections with other teachers, getting inspired", liked "resources and contacts for implementing a school garden", appreciated "getting excited about the possibilities, getting contact info, and meeting other teachers with similar goals" and "the journal ideas and the wealth of contact information for potential field trips."

Many teachers also offered suggestions for future trainings. Suggestions included: "more project ideas", "more plant identification on the trails", and "more [interaction with] resource specialists". During interviews with teachers, we learned that teachers desire more support from principals, curriculum directly tied to state benchmarks, assistance with working with students in the outdoors, and workshops directly connected to their schools and/or with a field trip component. In order to address these suggestions, we have made specific changes in our teacher workshops, teacher follow-ups, local resources, and curriculum development for the future.

This being our first attempt to begin a new way of assisting teachers, we also gained some valuable perspective on creating relevant teacher workshops and support programs. Over the past eighteen months, we have learned the value of taking the time to develop a long term relationship with teachers as well as with specific schools. This relationship building has allowed us to work with teachers and their principals as partners with a common vision rather than simply lead workshops without acknowledging the needs of teachers. However, we have also been surprised by the amount of time that needs to be invested in the initial stages of these relationships. Although we have had teachers participating in the program over the last year we find that it is now, after eighteen months, that we are at a place where we are cooperatively planning with schools, teachers, and other local agencies to carry these ideas forward. We are grateful that we have had this time to begin this program, and we look forward to continuing to support teachers in the region into the future.

Teacher Workshops

We have already begun adjusting the way we support teachers. We will continue to offer high quality workshops focusing on our local ecological and cultural communities for teachers and integrate in the teachers' suggestions. The three workshops we have scheduled for this summer directly address these suggestions. In the first, teachers will gain even more practical place-based education project ideas and strategies while learning from professionals in the place-based education field. In the second, teachers will gain insight into the types of projects they can complete at their schools as well as practical expertise in accomplishing these projects. In the third, teachers will learn directly how best to work with their students in the outdoors on field projects. As some teachers noted that they preferred a field trip component, we have already expanded our existing Ethnobotony program, which focuses on local cultural history, to include a hands-on field trip to a life-size, modern replica of a traditional Chinook long house. Listening, evaluating, and making adaptations has allowed us to make new programs more meaningful for participants.

Teacher Follow-Ups

From several teachers, we received feedback that they would like to know more about NW plants and general ecology. Because of this we will expand upon our existing interpretive walks to begin monthly Saturday morning interpretive hikes especially for teachers. During these hikes, teachers will learn more about NW ecology, have time for questions, learn how to bring these concepts into their classrooms, and meet other teachers with similar interests.

Local Resources

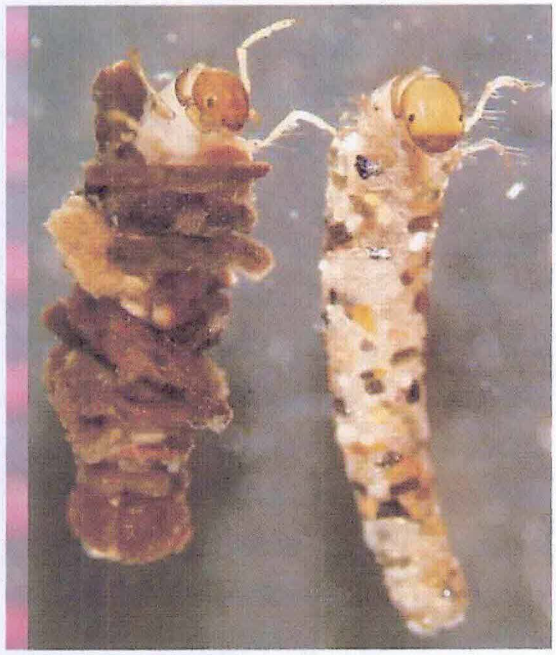
The Friends have also been working with many other educators to establish a place-based education network in Oregon that will link teachers with area non-profits and governmental agencies. Every teacher that attends a workshop with the Friends of Tryon

Creek State Park will be introduced to this network. Through this connection, teachers will have easy access to local resources and specialists. We will also continue to connect teachers with valuable resources such as Metro environmental education program, City of Portland and Lake Oswego educators, and other local non-profits.

Curriculum Development

Many teachers expressed a desire for coordinated work with schools. We have established relationships with two of our local schools and will be working with both the principals and teachers during the upcoming year to provide support both here at the park and in their schools. These established relationships will allow us to work directly with the teachers to adapt their existing curriculum with place-based education techniques as well as ensure administrative support for any planning and implementation time. By working directly with schools, including parent volunteers, we can ensure that the curricular changes will be, over the long term, sustainable.



Teachers,

It was so wonderful to meet you all in October during the first Ecological Teachers Training Series meeting. I hope that you have been able to start to plan how you can integrate your local green areas into your classrooms. There are a few points I wanted to pass on to you before the end of the term.

- If you would like to receive credit for this course you will need to complete the following steps.
  - Complete the registration form and return, with payment (made out to PSU) to Friends of Tryon Creek. by Nov. 30, 2005 @
  Friends of Tryon Creek State Park PO Box 812, Lake Oswego, OR 97034
  - Attend one weekend hike. The Saturday interpretive hike schedule is available on our website at www.TryonFriends.org . Also, the teachers' hike will be Dec. 17th.
  - Complete one sample lesson plan utilizing place-based education techniques.
  - Attend final meeting on Wed. Dec. 7 from 6-8:30 pm to review curriculum, plan for the next term and complete course evaluation.

- If you did not pay the $15 materials fee the day of the class, please send your payment to:
  Friends of Tryon Creek State Park PO Box 812, Lake Oswego, OR 97034

- You are all invited to attend our first teacher's walk on local native trees on Saturday, Dec. 17th from 8-9:30 am. Drop me an e-mail if you will be coming. I will be holding these hikes on varying themes once a month. Please feel free to invite friends.

- Our next class in Feb. 11, 2006. I hope that you will all be able to join us. We can have up 20 people in this course so invite a teaching partner to join us in February.

- Finally, Greg Smith at Lewis and Clark College is beginning a contact list of teachers in the NW interested in Place-Based Education. If you would like to be included on that list, let me know.

Give me a call or drop an e-mail if you have any questions.
I'll see you in February!

Sheilagh Diez

Ecological Teacher Training Series
OCT. 22, 2005
Friends of Tryon Creek State Park

Evaluation Form

Name (Optional): ____________________

Please rate the following areas and provide additional comments as you desire.

Introduction and Background in Place-Based Education

1 2 3 (4) 5

Native Plants Hike

1 2 3 (4) 5

Resource Specialist Focus Groups

1 2 (3) 4 5

Curriculum Brainstorming

1 2 3 (4)—(5)

What is the most useful thing you have gained from this training? Sheilagh was very knowledgeable + helpful. What a gorgeous spot you have here! I appreciate the support you extend to "formal" educators! Very well structured

What improvements can be made for the next session of the Ecological Teacher Trainings Series? I can't think of any at the moment; See you again!

Would you like to receive monthly updates on interpretive hikes, adult classes, and teacher trainings? ____ E-mail address roo22moy@hotmail.com

Thank you, we look forward to working with you in the future.

Ecological Teacher Training Series
OCT. 22, 2005
Friends of Tryon Creek State Park

Evaluation Form

Name (Optional): Kenny Meddy

Please rate the following areas and provide additional comments as you desire.

Introduction and Background in Place-Based Education

1 2 3 4 (5)

Native Plants Hike

1 2 3 4 (5)

Resource Specialist Focus Groups

1 2 3 (4) 5

Curriculum Brainstorming

1 2 3 4 (5)

What is the most useful thing you have gained from this training?
Getting exciting about the possibilities - getting contact info & meeting other teachers with similar goals.

What improvements can be made for the next session of the Ecological Teacher Trainings Series?

Would you like to receive monthly updates on interpretive hikes, adult classes, and teacher trainings? ✓ E-mail address already on list

Thank you, we look forward to working with you in the future.

Ecological Teacher Training Series
OCT. 22, 2005
Friends of Tryon Creek State Park

Evaluation Form

Name (Optional): Kim Crowell

Please rate the following areas and provide additional comments as you desire.

Introduction and Background in Place-Based Education

1 2 3 (4) 5

probably needed some follow up on place-based ed at end of session?

Native Plants Hike

1 2 3 (4) 5

Resource Specialist Focus Groups

1 2 3 4 (5)

Curriculum Brainstorming

1 2 3 (4) 5

What is the most useful thing you have gained from this training?

Resources and contacts for implementing a school garden.

What improvements can be made for the next session of the Ecological Teacher Trainings Series?

I would have liked more plant identification on the hike.

Would you like to receive monthly updates on interpretive hikes, adult classes, and teacher trainings? Yes E-mail address kcrowell@pps.k12.or.us

Thank you, we look forward to working with you in the future.

Thanks!

Center for Continuing and Professional Studies
Lewis & Clark College

Learning Where We Are: Developing Curriculum Around Local, Natural, and Social Communities

Wednesday- Friday

June 28, 4 p.m.- 7 p.m., June 29, 11 a.m.-8 p.m., June 30, 8:30 a.m.- 12:30 p.m.

Tryon Creek State Park

Neighborhoods surrounding schools provide a rich but often untapped source of curriculum and learning activities. Learn about placed-based education, an approach to teaching and learning that is grounded in the schoolyard, neighborhood parks, commercial areas, and local citizenry.

The class will take place at Tryon Creek State natural area, adjacent to Lewis & Clark College, and include hands-on learning activities in biological field studies and the history of land use in this watershed. Skills tied to water quality testing, plant identification, interviewing, and primary document analysis are woven into learning activities. Attention is paid to linking place-based learning experiences to state standards and benchmarks.

Key Presenters

Greg Smith of Lewis & Clark Graduate School of Education and Counseling
Marta Turner of the NW Regional Education Service District
Sheilagh Diez of Friends of Tryon Creek State Park

Credit Options

Noncredit/PDU:
15 hours, $260

Continuing Education Credit:
CEED 866. 1 semester hour, $340

Degree-applicable Credit:
ED 648, 1 semester hour, $610

Registrer by June 14, 2006

Workshop Registration

Name______________________________

Address______________________________

City/State/Zip______________________________

Day Phone______________________________

Visa/Mastercard #______________________________

Vcode______ Expiration Date__________ Amt Enclosed_______

Signature______________________________

Center for Continuing and Professional Studies ▪ 0615 SW Palatine Hill Rd ▪ Portland, OR 97219

Phone 503.768.6040 ▪ Fax 503.768.6045

Summer TeacherWorkshops

Walking Softly" Workshops provide educators with the opportunity to:

- ✓ Meet local environmental educators
- ✓ Visit field trip sites in the Portland area
- ✓ Plan safe and environmentally friend field trips
- ✓ Learn to encourage environmentally responsible behavior in students
- ✓ Share your field trip experiences
- ✓ Learn from fellow teachers

Participants Receive either 1 Graduate Credit or a $75 cash stipend. "Walking Softly" was funded by the Environmental Protection Agency and sponsored by Portland State University's Center for Science Education to mentor teachers who are new to the field, inexperienced with leading field trips, or looking for new field trip practices

June 27 - 28	**August 15 - 16**
Field Site 1: Location: Whitaker Ponds Ecosystem: Slough/wetland Curriculum: Streamside restoration Partnering Agency: Columbia River Slough Watershed Council	*Field Site 1:* Location: Balch Creek Ecosystem: Urban forest/riparian area Curriculum: Macroinvertibrates and water quality Partnering Agency: Bureau of Environmental Services
Field Site 2: Location: Johnson Creek Ecosystem: Creek/wetland Curriculum: Plant identification Partnering Agency: Bureau of Environmental Services/Portland Parks and Recreation	*Field Site 2:* Location: Tryon Creek Ecosystem: Urban forest/riparian area Curriculum: Restoration Partnering Agency: Friends of Tryon Creek

Workshop Outline: We will meet at each field trip site at 8:30am and finish at 4pm. Lunch will be provided on the first day, but please bring a sack lunch for the second day . Dress for the weather. Any required equipment will be provided. Activities will be hands on and will include (depending on field site and curriculum) environmentally friendly insect collection, plant identification, water quality testing, restoration techniques, and in-class trip preparation techniques. For more complete information, please **contact**:

Kristen Schou or Julie Smith (503) 725-4252
kschou@pdx.edu smithj@pdx.edu

Ecological Teacher Training Series

Agenda

9:00 - 9:15 - **Welcome & Agenda**
9:15 -10:00 - **Introductions**
& Place-Based Education

10:00-10:15 - **Break**

10:15-10:30 - **Introduction of Ecological Concepts**
10:30-12:00 - **Hike and Exploration**
12:00-12:30 - **Literacy Through the Natural World**

12:30-1:00 - **Lunch**

1:00-1:45 - **Resource Focus Groups**

1:45-2:00 - **Break**

2:00-2:45 - **Curriculum Mapping**
2:45-3:00 - **Closing and Evaluation**

Place-Based Education

Definition

by David Sobel

- Place-Based education is the process of using the local community and environment as a starting point to teach concepts in language arts, mathematics, social studies, science, and other subjects across the curriculum. Emphasizing hands-on real world learning experiences, this approach to education increases academic achievement, helps students develop stronger ties to their community, enhances students' appreciation for the natural world, and creates a heightened commitment to serving as active, contributing citizens. Community vitality and environmental quality are improved through the active engagement of local citizens, community organizations, and environmental resources in the life of the school.

Resources

- Place-Based Education Evaluation Collaborative http://www.peecworks.org/
- Principles of Place-Based Education http://www.ruraledu.org/roots/rr304b.htm
- Place-Based Education David Sobel
- The Geography of Childhood Nabhan & Trimble
- Last Child In The Woods Richard Louv

1st Training

Northwest Natives

Main Concepts

- Native Plants of Tryon Creek SP
- Difference between native and non-native
- Difference between invasive and non-invasive

Usefulness of Native Plants

- Beauty
- Well Adapted for Climate – Less Care
- Wildlife Habitat and Food
- Erosion Prevention

Resources

- Native Plant Society of Oregon http://www.npsoregon.org/
- Portland Parks and Recreation: Native Plants http://www.parks.ci.portland.or.us/TreesPlants/NativePlants/NativePlants.htm
- Oregon State University: Native and Naturalized Woody Plants of Oregon http://oregonstate.edu/dept/ldplants/native-or.htm
- Washington State University Native Plant Gardening http://gardening.wsu.edu/text/nwnative.htm
- Gresham high school Flora and Fauna of the NW http://ghs.gresham.k12.or.us/science/ps/nature/nature.htm

Plant Identification

Main Concepts

- Leaf Shapes
- Leaf Margins
- Leaf Arrangement and Structures

Divisions Between Forest Organisms

- Animals - Animalia
- Plants - Plantae
- Fungus - Fungi
- Lichens – (within Fungi)
    - crustose (paint-like, flat)
    - foliose (leafy)
    - fruticose (branched)

Resources

- For various leaf shapes http://theseedsite.co.uk/leafshapes.html
- USDA Plants Database http://plants.usda.gov/
- Botany in a Day Thomas Elpel
- Plants of the Pacific Northwest Coast Pojar and MacKinnon

Tryon Creek State Park

Trees & Shrubs

Common Conifers

- Douglas Fir (*Pseudotsuga menziesii*)
- Grand Fir (*Abies grandis*)
- Western Hemlock (*Tsuga heterophylla)*
- Western Red Cedar *(Thuja Plicata)*

Common Broadleaves

- Big Leaf Maple (*Acer Macrophyllum)*
- Oregon Ash (*Fraxinus latifolia*)
- Red Alder (*Alnus Rubra)*

Common Shrubs

- Elderberry (*Sambucus racemosa*)
- Himalayan Blackberry (*Rubus discolor)*
- Indian Plum (*Oemleria cerasiformis*)
- Red Huckleberry (*Vaccinium parvifolium*)
- Salal (*Gaultheria shallon*)
- Salmonberry (*Rubus spectabilis*)
- Thimbleberry (*Rubus parviflorus*)
- Vine Maple (*Acer circinatum)*

Tryon Creek State Park

Flowers & Ferns

Flowers & Herbaceous Plants

- Western Trillium (*Trillium ovatum*)
- Pacific Waterleaf (*Hydrophyllum tenuipes*)
- Creeping Buttercup (*Ranunculus repens)*
- Wild Ginger (*Asarum caudatum*)
- Miner's Lettuce (*Montia perfoliata)*
- Yellow Wood Violet (*Viola glabella)*
- Stinging Nettle (*Urtica dioica)*
- Dock (*Rumex crispus*)
- Skunk Cabbage (*Symplocarpus foetidus*)
- Duck's Foot (*Vancouveria hexandra*)

Ferns

- Sword Fern (*Polystichum munitum*)
- Licorice Fern *(Polypodium glycyrrhiza*)
- Bracken Fern (*Pteridium aquilinum)*
- Maidenhair Fern (*Adiantum aleuticum*)
- Lady Fern (*Athyrium filix-femina*)
- Horsetail Fern (*Equisetum arvense*)

Urban Ecology

Definition

- Within the natural sciences, the term "urban ecology" is used to refer to biological and ecological studies conducted in areas with high densities of humans.

Issues

- Habitat Fragmentation
- Storm/Surface Water Run-Off
- Air, Water, and Soil Pollution
- Loss of Habitat
- Noise and Light Pollution
- Vehicle injury

Resources

- Urban Ecology Website http://www.urbanecology.org/
- ASU urban ecology site w/ lesson plans http://chainreaction.asu.edu/ecology/
- EPA site on storm water http://www.epa.gov/weatherchannel/stormwater.html
- Wikipedia the online encyclopedia http://www.wikipedia.org/

Carbon Cycle

Definition

- The movement of carbon, in its many forms, between the biosphere, atmosphere, oceans, and geosphere.

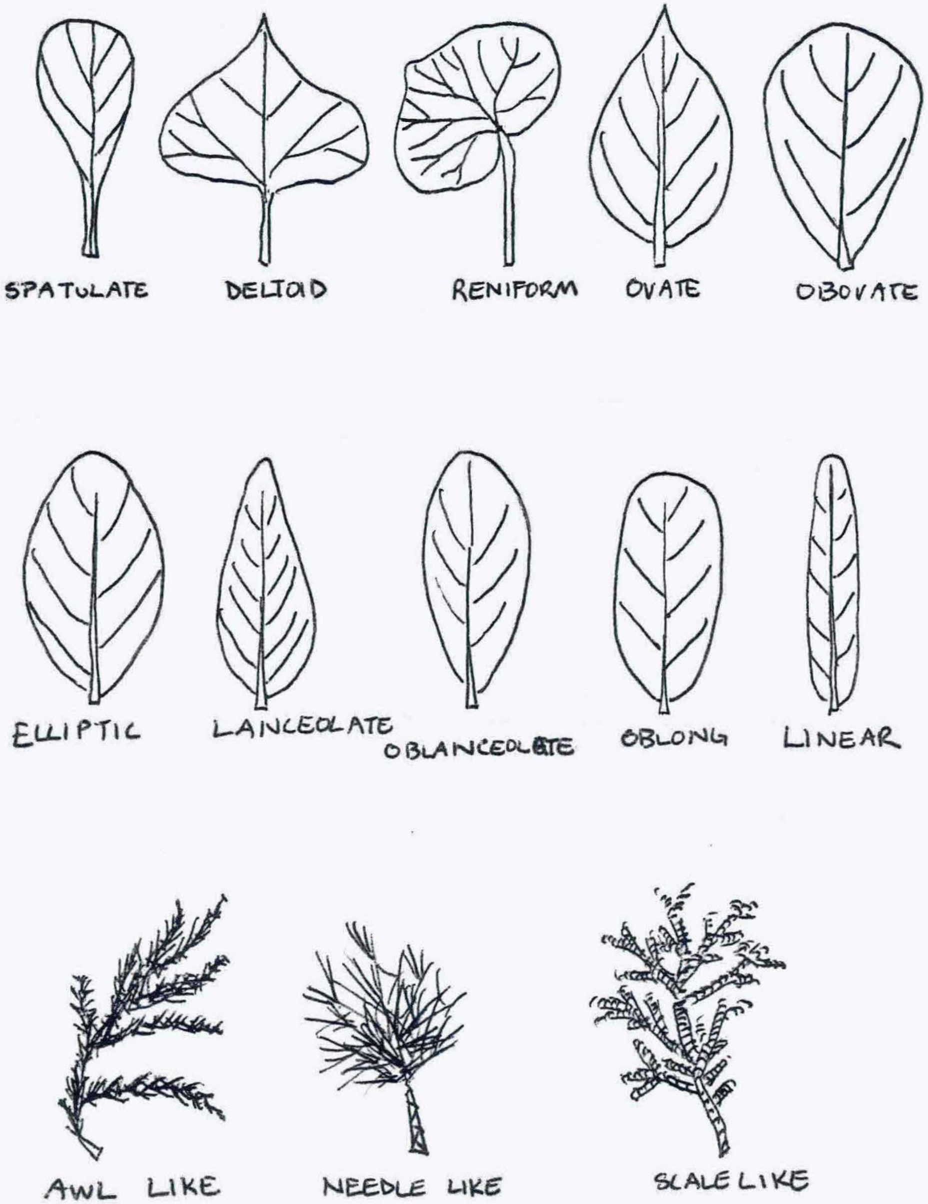
Components

- Plants absorb CO2 from the atmosphere during photosynthesis.
- Both plants and animals release CO2 back in to the atmosphere during respiration.
- The dissolved CO2 in the oceans is used by marine biota in photosynthesis and in shell production.
- Excess CO2 is produced through fossil fuel burning, coal, oil, natural gas, and gasoline consumed by industry, power plants, and automobiles.
- Agriculture, deforestation, and reforestation also increase CO2 in the atmosphere.

Resources

- Exploring the Environment http://www.cotf.edu/ete/main.html
- Think Quest A Trip Around the Carbon Cycle http://library.thinkquest.org/11226/index.htm
- Woods Hole Research Center - Carbon Cycle http://www.whrc.org/carbon/
- EPA Kids' Site on Global Warming http://www.epa.gov/globalwarming/kids/version2.html

LEAF SHAPES



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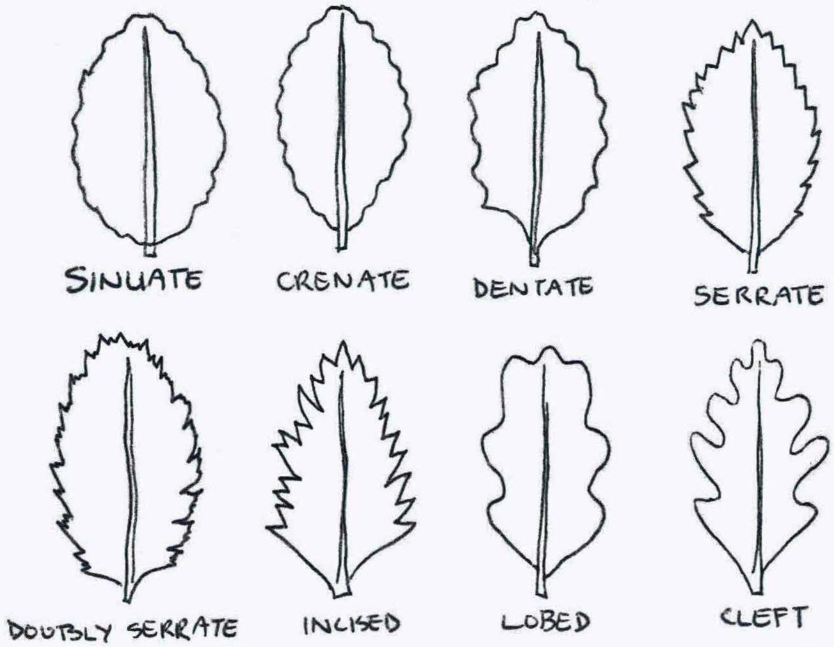

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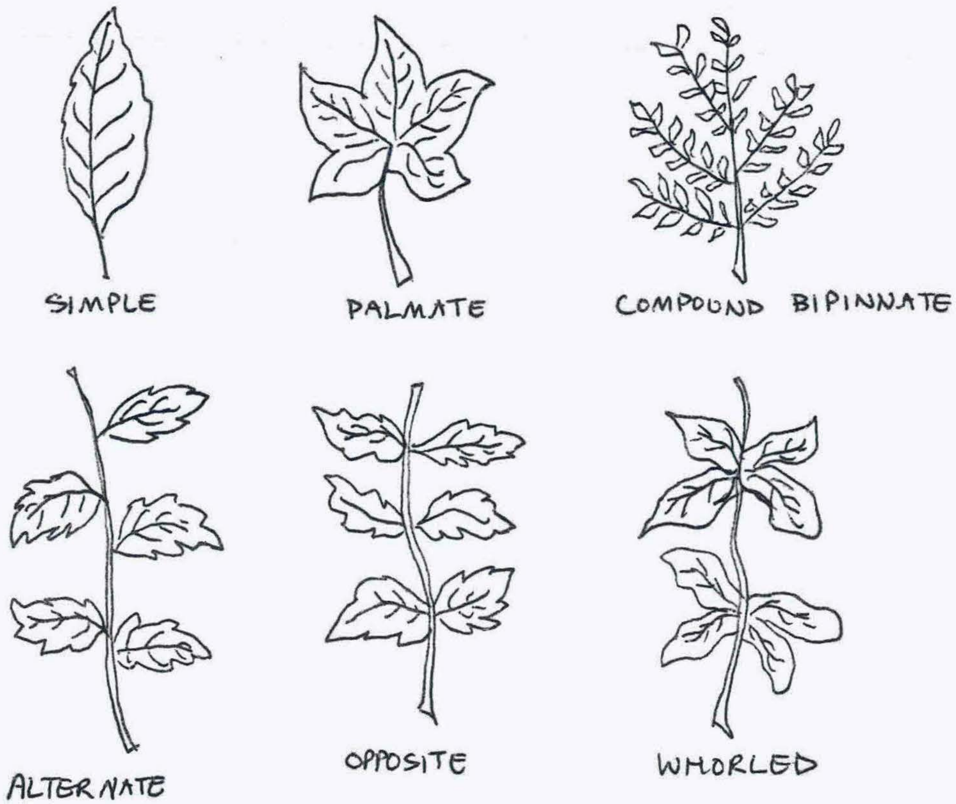
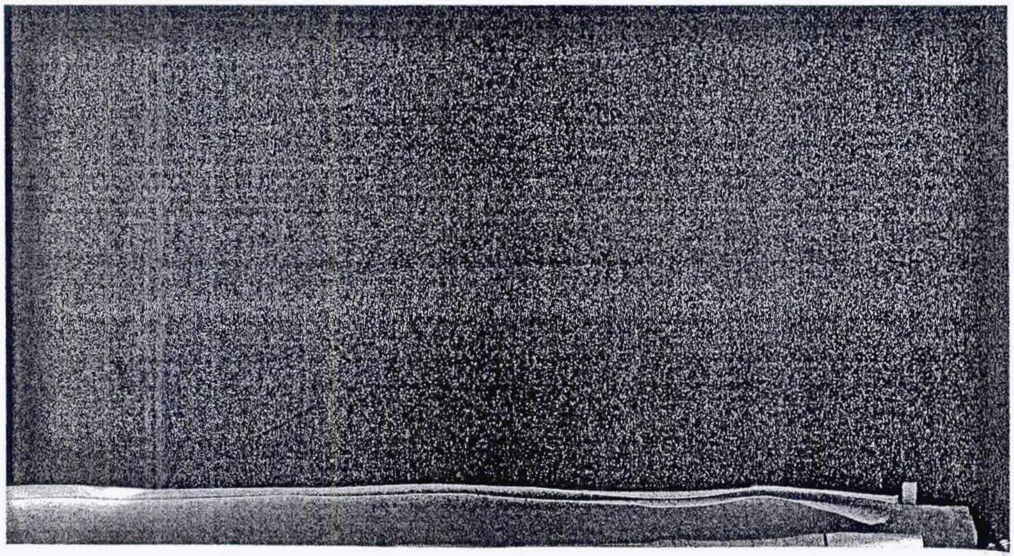


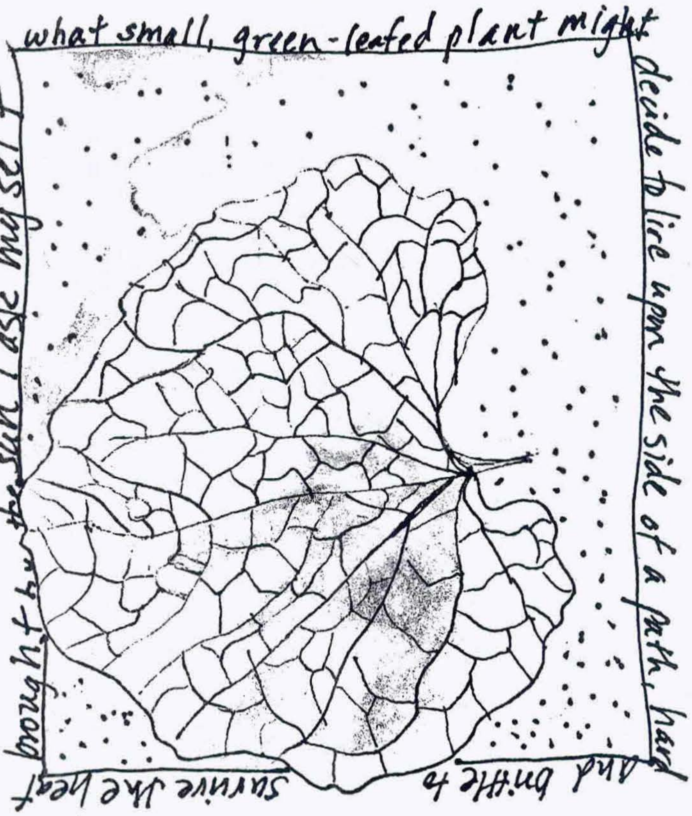
Lesson Title

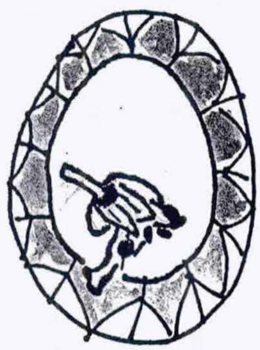
Essential Questions

Critical Content

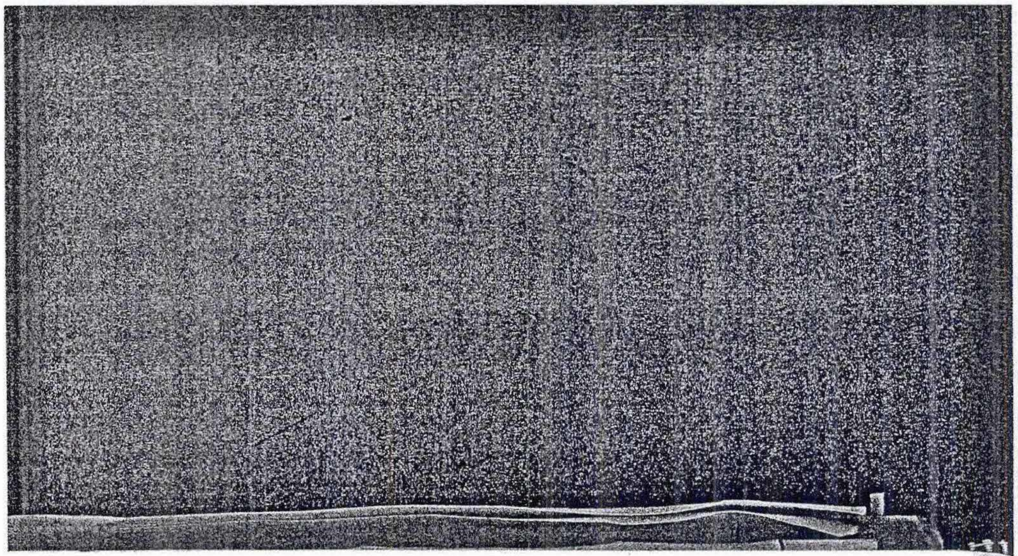
Essential Vocabulary

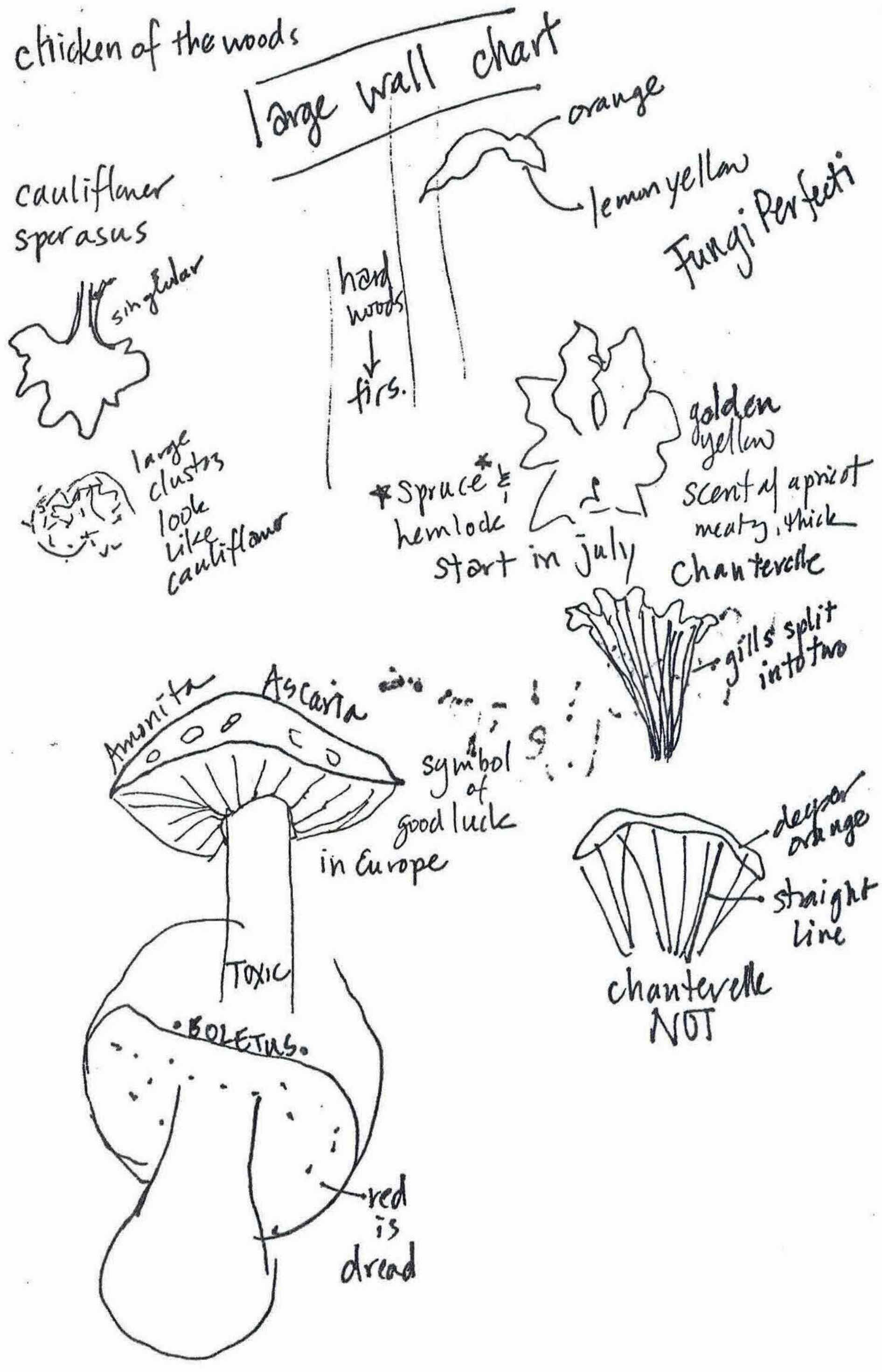


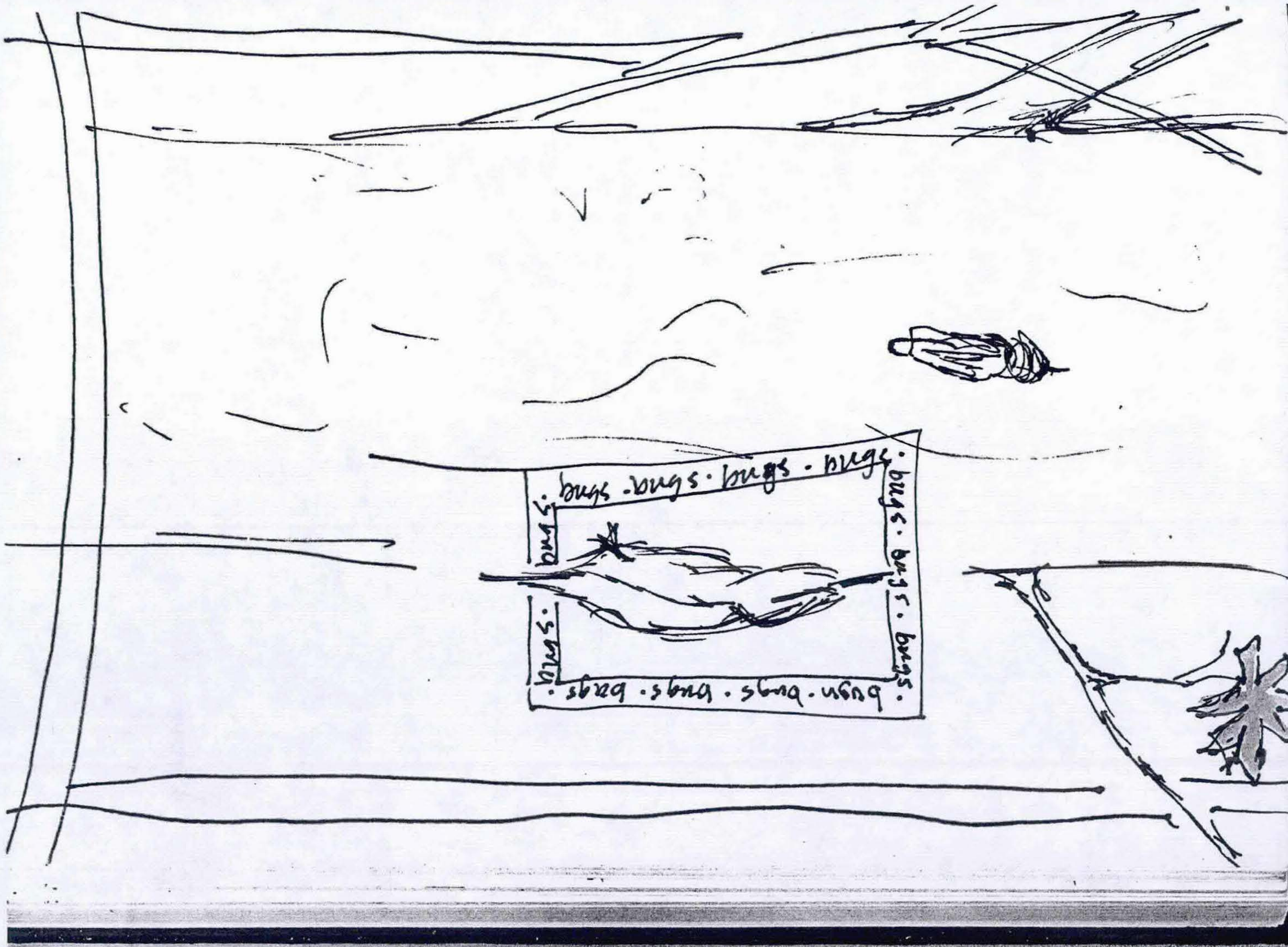

what small, green-leafed plant might
decide to live upon the side of a path, hard
and brittle to
survive the heat
brought by the sun I ask myself




* burst *
emerge
grow
breathe
* taste * * sing *




chicken of the woods
large wall chart
orange
lemon yellow
Fungi Perfecti
cauliflower
sperasus
singular
hard woods
firs.
large clusters look like cauliflower
* spruce* & hemlock
start in July
golden yellow
scent of apricot
meaty, thick
Chanterelle
gills split into two
Amonita Ascaria
symbol of good luck in Europe
deeper orange
straight line
chanterelle NOT
TOXIC
•BOLETUS•
red is dread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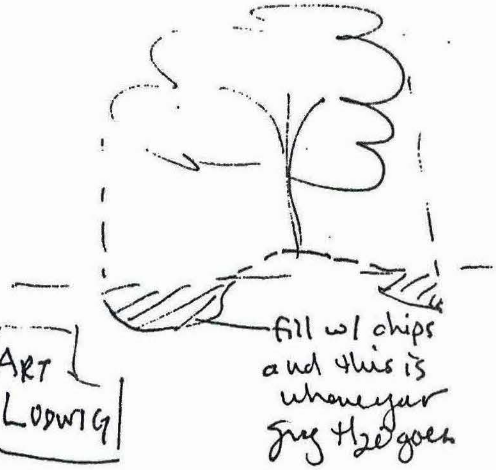
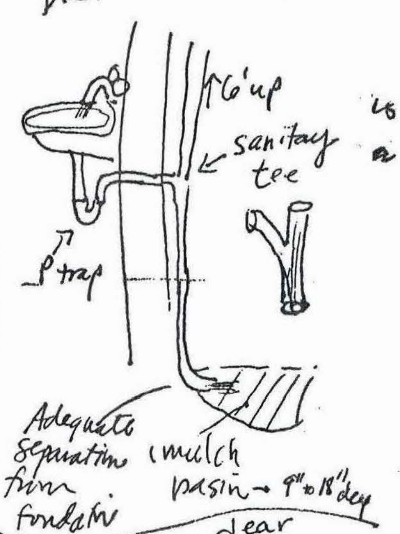
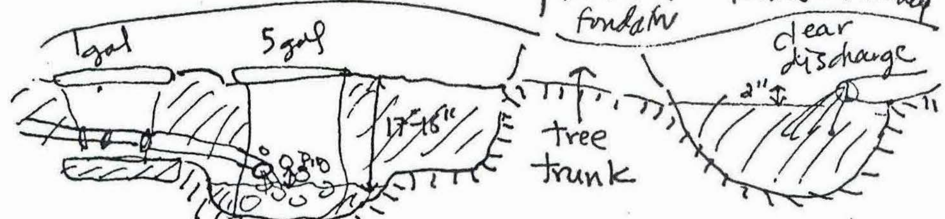
DRAIN to M.B.

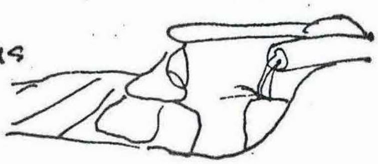


ART
LUDWIG



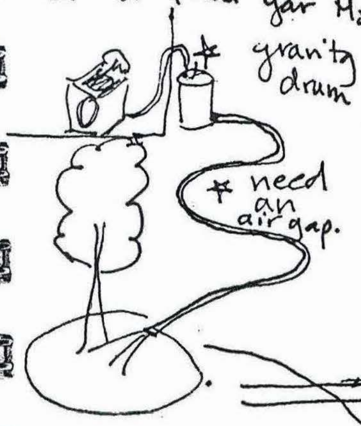


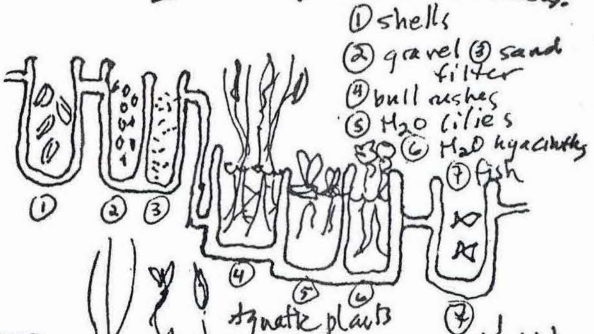
Branched Drain Fed Mulch Basins



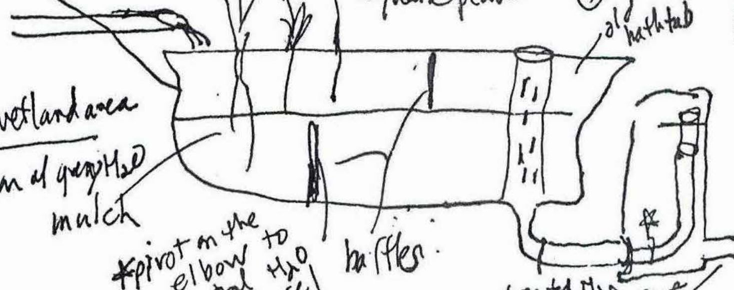
(you want @ least a 2% fall
so that your H_2O will flow)

design it so it works.





$\frac{1}{2}$-1 ft² wetland area
/ 1 gallon of grey H_2O



7 WAYS OF LOOKING AT VICTORIA'S HAND

A smooth starfish
Curls around cries, cotton, air,
Hair.

A five-legged spider
Does pushups on my sweater.

A wing of wet feathers
Flickers against my chin.

Reading her palm, I see
Fresh flights.

A web to catch
Rainbows and bread.

I see
Scars.

And stars.

—Carol F. Peck

sharp bursts of sound

encompasing us

vegetation everywhere

moss covering the trees

Beam of Sunlight
that disappears and reappears

the trees protect

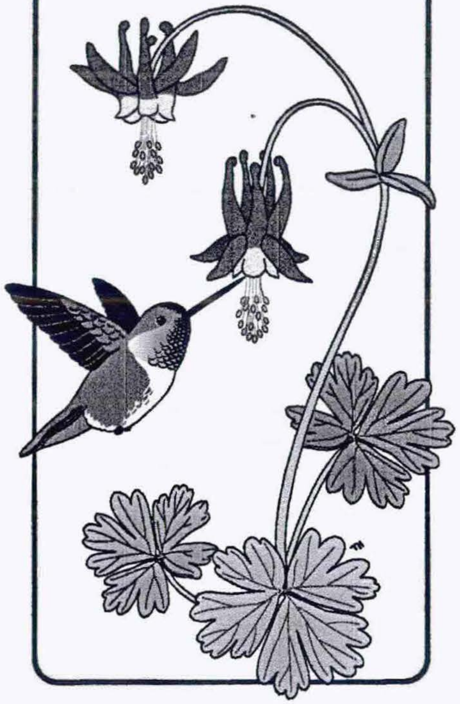
hold and carry these woods

Native Plant Society of Oregon
PO Box 902
Eugene, OR 97440

a member of Earth Share of Oregon

Native Plant Society of Oregon

Guidelines for the
Use of
NATIVE PLANTS
for
GARDENING



Gardening with Native Plants

Pacific Northwest natives can satisfy aesthetically, practically, and ecologically. Grow them and enjoy them. Whether you "go native" all the way or mix natives with plants from other lands, you can expect pleasure from the beauty that natives can bring to your garden.

~ Art Kruckeberg, from *Gardening with Native Plants of the Pacific Northwest* (1996)

Have you walked through a meadow and been impressed with the colorful array of native wildflowers? Do you enjoy the beauty of natural areas that you visit in Oregon? Do you like watching birds or butterflies use plants for the different resources they provide? Are you interested in protecting or enhancing natural areas in your community? If you answered 'yes' to any of these questions, you may also be interested in incorporating native plants into your home garden.

Growing natives in your garden is a great way to gain familiarity with native plants. In addition, using native plants in your garden can be a logical extension of your concern for preserving some of Oregon's natural heritage. In your garden, you can provide habitat for native plants and the great array of animals and other organisms that depend on them.

The Native Plant Society of Oregon (NPSO) encourages you to grow Oregon native plants in your garden. However, while there are several hundred plants native to Oregon that make good garden plants, not all are native to your area of Oregon. The purpose of this document is to outline guidelines that the NPSO hopes you will follow to maximize the ecological and practical benefits of native plant gardening.

Guidelines for gardening with native plants

By following these guidelines, you will be able to grow natives successfully in your garden and enjoy the beauty and ecological benefits of native plants.

Use plants that are native to your ecoregion (*see map*). What is an ecoregion? Ecoregions are areas that are relatively uniform in soils, vegetation, climate, geology, and wildlife. Ten ecoregions are recognized in Oregon. Plants from within your ecoregion are most likely to do well in your garden.

Choose plants that grow well in the unique conditions of your garden. The particular conditions of soil type, soil moisture, and amount of sunlight may vary in different parts of your garden. You will want to select the right plants to fit the various conditions present. For example, if part of your yard doesn't drain well, you could plant natives that grow naturally in boggy places. Local NPSO chapters may have lists of native plants in your ecoregion, along with descriptions of the conditions under which they grow best. Study your locally native plants where they grow in the wild and observe the conditions in which they are growing. There are numerous field guides and several gardening books that can help you identify your locally native plants and may describe suitable conditions for growing them.

Select plants that originated from as close to your home as possible. Plants that occur in your ecoregion and that originate close to your garden site are locally native. By using locally native plants, you will preserve the natural heritage of your community. In addition, you will have a higher probability of successfully establishing the plants than if you use plants that originated from far away.

Select healthy-looking plants. Healthy plants exhibit vigorous growth, are not wilted, have good foliage color, and are free of insect damage and spots on the leaves. Healthy nursery plants will have a good chance of growing well in your garden. But remember, once they are growing well in your garden, native plants may attract caterpillars, butterflies, and other animals that depend on these plants for their own survival. Welcome these visitors! Attracting these animals to your garden is one of the many benefits of gardening with natives!

For best results, plant in the spring or fall. At other times of the year, plants will need greater amounts of attention (e.g., watering) in order to flourish. Be aware that even drought-tolerant natives require supplemental water until they are established and that not every plant you choose may grow well. Enjoy experimenting with different native plants from the ecoregion and microsite types appropriate for your particular garden.

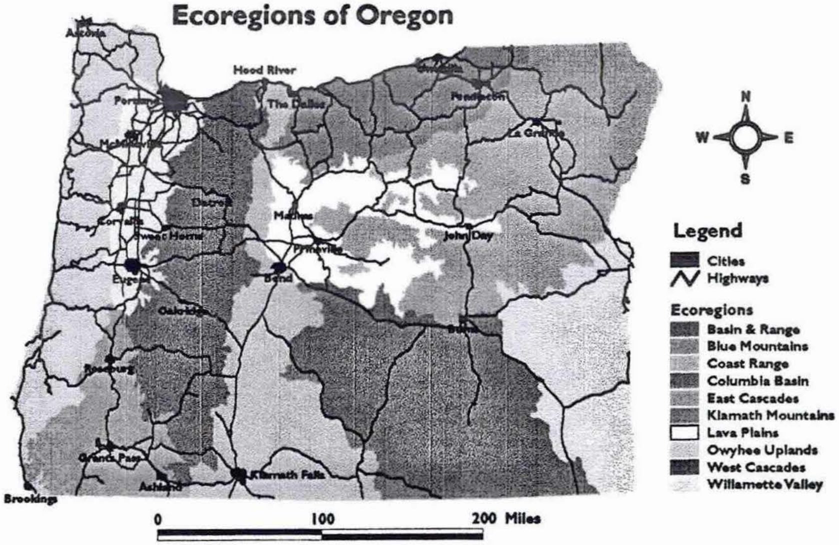
Avoid using invasive non-native plants. If you choose to plant non-natives, research their growth habits first. Beware of plants described as "vigorous." Non-native invasive plants are a serious cause of habitat destruction because they take over and exclude native plants and the animals that depend upon them. Many of these were originally imported as garden ornamentals. For lists of invasive, non-native plants, visit one of the web sites listed at the end of this document.

Sources of native plants

Once you have determined what locally native plants would grow well in your garden, you are left with another challenge—finding a place where you can obtain or purchase them. Fortunately, the demand for native plants is steadily increasing and many nurseries now specialize in native plants, while others carry a selection of natives along with non-native ornamentals.

Here are a few tips on how to find locally native plants, and how you can encourage an increasing availability of native plants in the future:

Contact local nurseries. If they have a selection of native plants, show your appreciation for this. Ask about the source of the plant material and the propagation method used by the nursery. Ideally, the plants should be propagated from seeds or cuttings within your ecoregion and not wild-collected. For more on propagation techniques see the NPSO policy on ethical propagation on our website.



The ten ecoregions of Oregon, as depicted by the Oregon Natural Heritage Program and the Oregon Department of Fish and Wildlife. For more information see http://www.natureserve.org/nhp/us/or/tebook.pdf.

Visit the NPSO website to get contacts for your local chapter, and attend your local NPSO chapter meetings and field trips. Many NPSO members are active native plant gardeners, and know sources for locally native plants.

Do not transplant from the wild. Unless their natural habitat is threatened by immediate destruction, and you have obtained landowner permission, transplanting native plants to your garden is strongly discouraged because it can damage natural plant communities. In addition, state law forbids the collection of many plant species.

Benefits of gardening with locally native plants

If you establish locally native plants in your garden, you will reap numerous benefits such as:

- Growing locally native plants in your garden helps ensure habitat for plants and the animals that depend on them. For example, many of our native butterflies depend on a single native plant species during their caterpillar stage.
- Many native plants are very attractive.
- Locally native plants are adapted to local soil and climate conditions, making many of them easier to maintain than non-native species.
- Planting locally native plants reduces the risk of introducing invasive plants into your community.
- Using locally native plants, rather than natives from elsewhere, prevents the unique genetic makeup of native plants in your area from being altered.

For more information

Alden, P. *et al.* 1998. *National Audubon Society Guide to the Pacific Northwest.* Knopf, New York.

City of Portland Bureau of Planning. 1997. *Portland Environmental Handbook.*

Guard, B. J. 1995. *Wetland Plants of Oregon and Washington.* Lone Pine Publishing, Renton, Washington.

Kruckeberg, A.R. 1996. *Gardening with Native Plants of the Pacific Northwest.* Second edition, revised and enlarged. University of Washington Press, Seattle, Washington, (highly recommended).

Mathews, D. 1999. *Cascade-Olympic Natural History.* Second edition, updated and expanded. Raven Editions, Portland, Oregon.

Pojar, J., and A. MacKinnon. 1994. *Plants of the Pacific Northwest Coast.* Lone Pine Publishing, Renton, Washington.

Rose, R., C.E. Chachulski, and D.L. Haase. 1998. *Propagation of Pacific Northwest Native Plants.* Oregon State University Press, Corvallis, Oregon.

Strickler, D. 1993. *Wayside Wildflowers of the Pacific Northwest.* The Flower Press, Columbia Falls, Montana.

Wilson, M.V, D.E. Hibbs, and E.R. Alverson. 1991. Native plants, native ecosystems, and native landscapes: an ecological definition of "native" will promote effective conservation and restoration. *Kalmiopsis:* 13-17.

Web sites

Native Plants

Native Plant Society of Oregon
http://www.NPSOregon.org/

California Native Plant Society
http://www.cnps.org/

Idaho Native Plant Society
http://www.idahonativeplants.org/

Washington Native Plant Society
http://www.wnps.org/

City of Portland
http://www.planning.ci.portland.or.us/lib_plantlist.html

City of Salem
http://www.open.org/~naturalr/Plants/plant_index.htm

Nearby Nature
http://www.plantnative.org/

Butterfly Gardening

North American Butterfly Association
Eugene-Springfield Chapter
http://www.naba.org/chapters/nabaes/btrfly-gdng1.html

Invasive and Non-native Plants

The Nature Conservancy, Wildland Invasive Species
http://tncweeds.ucdavis.edu/

USDA, Natural Resources and Conservation Service
http://www.pwrc.usgs.gov/wlinews/sprsum99.htm

USDA, Noxious weed home page:
http://www.aphis.usda.gov/ppq/weeds/

Ecological Teacher Training Series
OCT. 22, 2005
Friends of Tryon Creek State Park

Evaluation Form

Name (Optional): ______________________________

Please rate the following areas and provide additional comments as you desire.

Introduction and Background in Place-Based Education

1 2 3 4 5

Native Plants Hike

1 2 3 4 5

Resource Specialist Focus Groups

1 2 3 4 5

Curriculum Brainstorming

1 2 3 4 5

What is the most useful thing you have gained from this training?

What improvements can be made for the next session of the Ecological Teacher Trainings Series? ______________________________

Would you like to receive monthly updates on interpretive hikes, adult classes, and teacher trainings? ____ E-mail address ______________________________

Thank you, we look forward to working with you in the future.

2nd training

Ecological Teacher Training Series - Map-making

Agenda

9:00 – 9:30 **Welcome, Agenda, and Reintroductions**

9:30 – 10:15 **Map-Making Introductions and Activities**

10:15 – 10:30 **Break**

10:30 – 12:00 **Ecological Components: Lichens, Mosses, and Soils**
Outdoor Interpretive Hike

12:00 – 12:30 **Lunch**

12:30 – 1:15 **Community-Based Education Strategies and Examples with Jon Yoder, North Salem High School and Chemeketa Community College**

1:15 – 1:25 **Break**

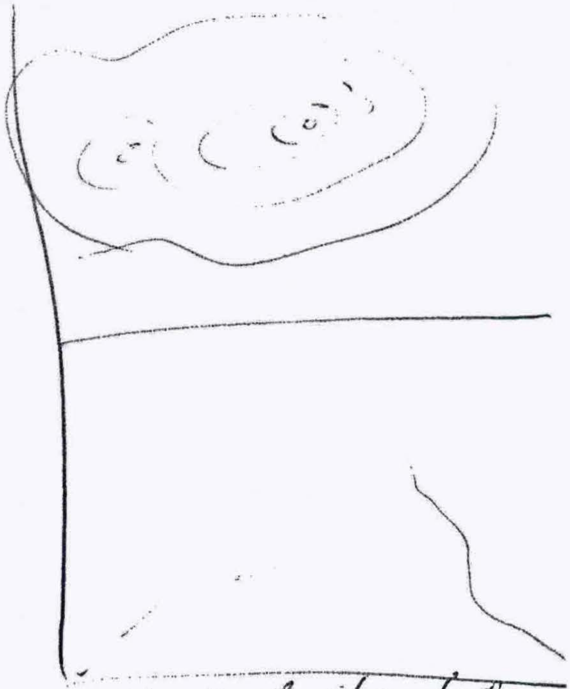
1:25 – 2:10 **Curriculum Mapping with Jon Yoder**

2:10 – 2:45 **Outdoor Mapping Activity**

2:45 – 3:00 **Closing and Evaluation**

- Identify 3 items in legend
different kinds of scale
bananas in Ecuador

- USGS legends 8"x11" sheet
- 20 sinks symbols simple
scale many



connect the dots

- letting rules

- bar graph precip line graph temp - climagraphs

every kid a thermometer @ different spots
around the area

Urban Temperatures

Use topo sheets for discussing historical events
International symbols
land use maps
* Oregon Atlas
Family Immigration Map 4 generations
do separate students then large group

- Use map like crater lake to talk about geology
and then legends.

Treasure hunts.

USGS office of Portland
By a program to put out
Tryon Creek map @ REI

- locations - water and mapping
What is important for kids to learn

why what applicability in the classroom.

Thoughts on Cartography

Components of Map

Title

Scale : different types 

bananas

Legend : line up symbol + explanation
keep symbols simple
refer to USGS legend


church
building
mine

Direction

Exercises : make scale drawing of football field 360 x 150
make map of classroom locating at least three items
map from home to school

Lettering Rules

attached rules that need modification
"devious" way to help location

Two Basic Maps

Qualitative - where something is located

Quantitative (choropleth) how much of something is located where

0 - 5
5 - 10
10 - 15

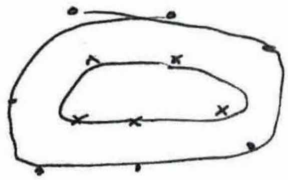
Steps -
1. rank order
2. divide into groups
3. round off numbers | make legend dark to light
4. select patterns / colors .. ~~high to low~~
5. Fill in map

Climagraphs

- attached examples
- gets students to compare different climates
- brings up discussion of rainshadow, altitude, distance from equator, proximity to large body of water, etc.

Topographic Maps

- local area / Tryon
- get creative - get Hanibal Missouri for Mark Twain
  Crater Lake to discuss volcanoes
  Guatemala to discuss settlement patterns
- contour lines
  - contour interval
  - connect dots to make contours



  - determine directional flow of stream
- create "treasure hunts"

MAP LETTERING RULES

A man has brought you a sketch map of the U.S. He knows that a map is just like a story or essay in that it can tell you a lot of information. Like other written work, it must give the information CLEARLY. But he says that he doesn't have the time to do a good, thoughtful job, so he has employed you to make the map for him. In order to make the map easy to read, you should follow these rules. You will need this equipment: pencil, ruler, eraser, colored pencils (NOT CRAYONS) and clean paper.

1. PRINT neatly.

2. Don't mix capital and lower case LEtteRS

3. Watch the size of your letters -- don't make the letters in WALDO larger than in MEDFORD because people might think that Waldo is larger than Medford.

4. Put PORTLAND and large cities in capitals.

5. Start smaller cities with capitals and then use lower case letters.

   For example: Cave Junction

6. Keep the letters for cities on a straight line all facing the same way.

   Not like this: Kerby

7. Letters for mountains and streams should follow the curve of the mountain or stream.

   For example:

8. Whenever possible, try to have names for roads and rivers on the same side. Maps should be able to be read from the south or east. Like these examples:

Map Lettering Rules Continued

9. Don't print letters upside down. Wrong:

10. Remember spacing--don't crowd too much into one area:

Wrong: • MEDFORD
• Phoenix
• ASHLAND

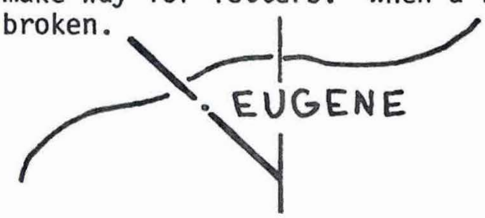
Right: MEDFORD •
• Phoenix
ASHLAND •

11. Spread out letters for mountain ranges to cover the whole area where they are located. For example:

C A S C A D E   M O U N T A I N S

12. On a map, letters are more important than anything else. Roads or streams can be broken to make way for letters. When a road crosses a stream, the stream should be broken.

For example:



13. <u>Always</u> use a ruler to make straight lines.

14. Select different colored pencils to indicate different items: blue for water; green for major highways, etc.

15. Change the width of streams and roads to indicate that some are bigger than others. For example:

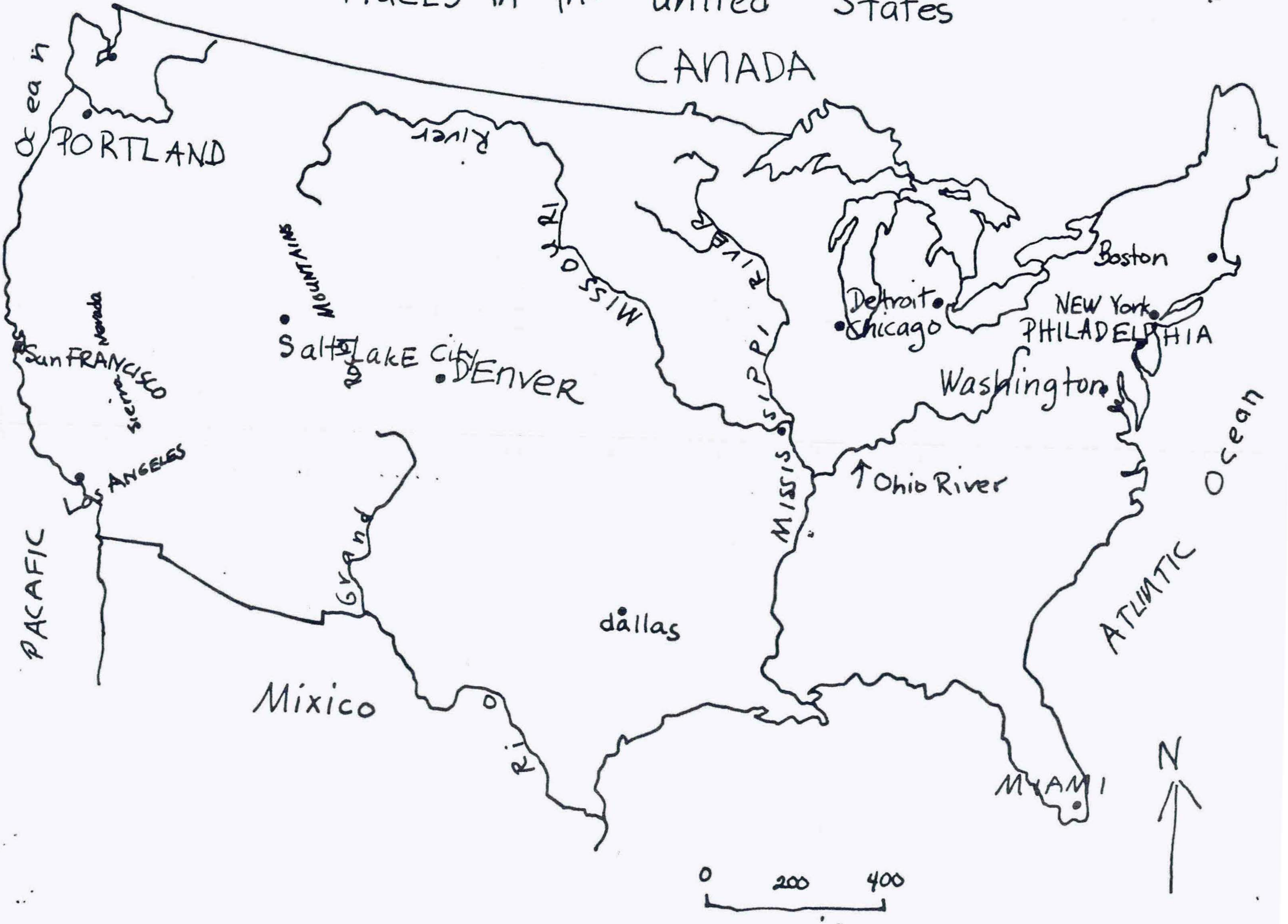
16. Avoid using abbreviations unless there is not enough space.

17. Do not use arrows to point to places. PLAN AHEAD.

18. CHECK ALL SPELLING.

19. Make a neat and clear legend. Include the title, scale and direction.

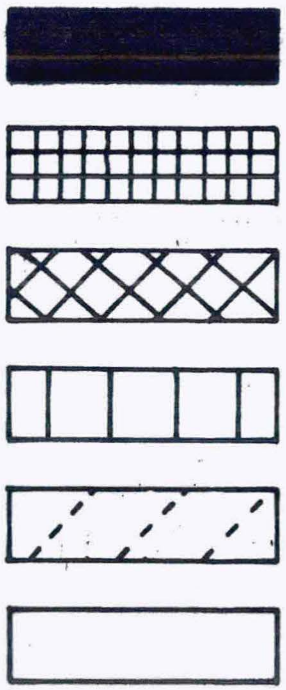
Places in the united States



MAPS SHOW QUANTITY

RULE: The eye should be led to the area of greatest quantity.

PATTERNS



(Use a ruler!)

COLORS

black

brown

dull red

orange

yellow

white

SYMBOLS

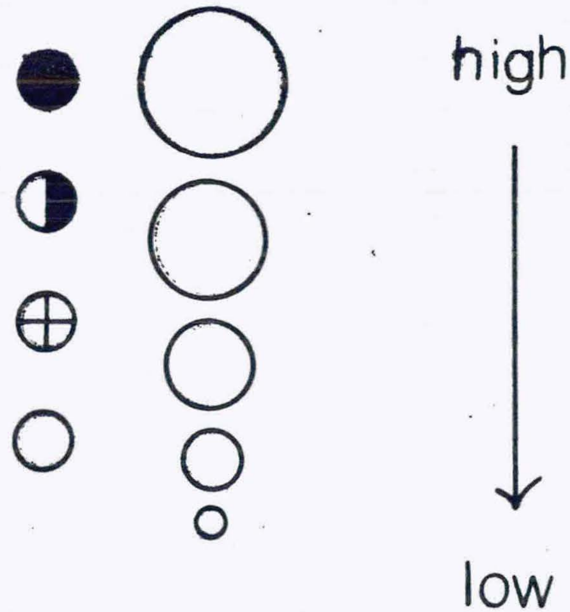
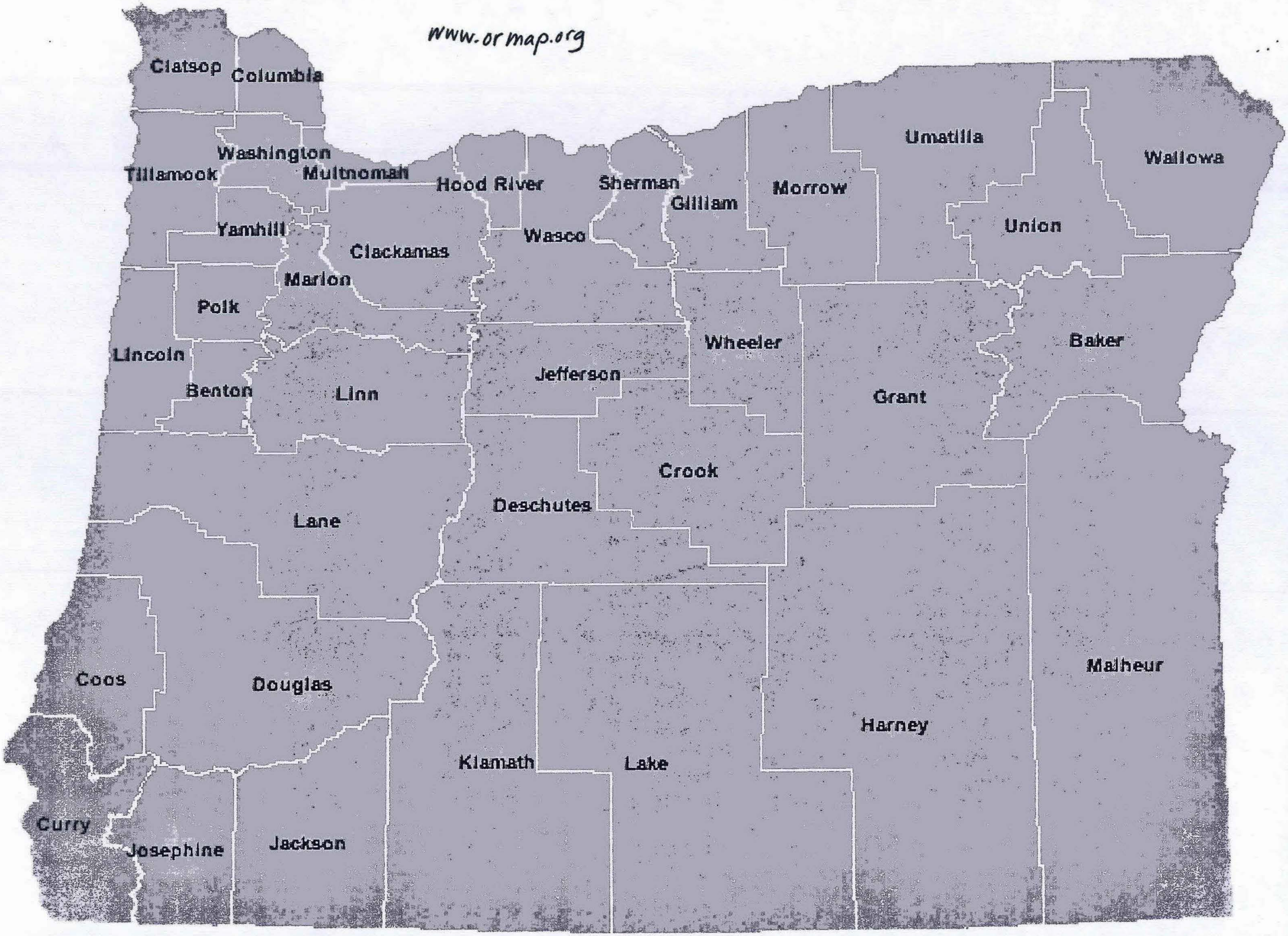


Table 4: Annual Estimates of the Population for Incorporated Places in Oregon, Listed						
Geographic Area		Population estimates			April 1, 2000	
		July 1, 2004	July 1, 2002	July 1, 2000	Estimates base	Census
Albany city	Oregon	43,889	42,278	40,923	40,866	40,852
Amity city	Oregon	1,459	1,468	1,476	1,478	1,478
Arlington city	Oregon	499	510	523	524	524
Ashland city	Oregon	20,755	20,536	19,609	19,522	19,522
Astoria city	Oregon	9,758	9,716	9,789	9,813	9,813
Baker City city	Oregon	9,746	9,754	9,886	9,896	9,860
Beaverton city	Oregon	82,907	81,150	78,440	78,095	76,129
Bend city	Oregon	62,937	57,141	52,619	52,029	52,029
Burns city	Oregon	2,854	2,938	3,065	3,065	3,064
Cannon Beach city	Oregon	1,659	1,619	1,589	1,588	1,588
Coos Bay city	Oregon	15,565	15,280	15,340	15,372	15,374
Corvallis city	Oregon	50,380	50,301	49,399	49,436	49,322
Cove city	Oregon	603	601	596	594	594
Elgin city	Oregon	1,634	1,639	1,654	1,654	1,654
Eugene city	Oregon	142,681	140,708	138,643	138,386	137,893
Fossil city	Oregon	447	462	468	469	469
Gold Beach city	Oregon	1,915	1,888	1,891	1,897	1,897
Grants Pass city	Oregon	27,195	25,831	24,873	24,780	23,003
Gresham city	Oregon	95,376	94,117	90,479	90,205	90,205
Hermiston city	Oregon	14,439	13,577	13,215	13,171	13,154
Hillsboro city	Oregon	81,854	75,641	70,920	70,169	70,186
Hood River city	Oregon	6,362	6,060	5,939	5,921	5,831
Independence city	Oregon	7,552	6,792	6,134	6,035	6,035
John Day city	Oregon	1,629	1,660	1,788	1,799	1,821
Klamath Falls city	Oregon	19,694	19,449	19,553	19,537	19,462
La Grande city	Oregon	12,371	12,478	12,510	12,506	12,327
Lincoln City city	Oregon	7,526	7,400	7,407	7,437	7,437
McMinnville city	Oregon	28,973	27,960	26,668	26,497	26,499
Madras city	Oregon	5,146	5,142	5,114	5,102	5,078
Medford city	Oregon	68,099	65,707	64,320	64,199	63,154
Milwaukie city	Oregon	20,755	20,607	20,481	20,490	20,490
Newport city	Oregon	9,627	9,558	9,508	9,532	9,532
Ontario city	Oregon	11,152	11,129	11,042	11,064	10,985
Pendleton city	Oregon	16,605	16,358	16,372	16,357	16,354
Portland city	Oregon	533,492	537,752	529,739	529,185	529,121
Port Orford city	Oregon	1,170	1,146	1,149	1,153	1,153
Prineville city	Oregon	8,575	7,970	7,636	7,568	7,356
Roseburg city	Oregon	20,447	20,092	20,055	20,054	20,017
Salem city	Oregon	146,120	142,706	137,399	137,026	136,924
Sandy city	Oregon	7,544	6,726	5,555	5,412	5,385
Seaside city	Oregon	6,023	5,889	5,899	5,909	5,900
Sisters city	Oregon	1,173	1,100	971	959	959
Springfield city	Oregon	55,048	54,001	53,110	52,995	52,864
Tigard city	Oregon	46,860	45,304	42,796	42,486	41,223
Tillamook city	Oregon	4,476	4,486	4,349	4,356	4,352
West Linn city	Oregon	25,051	24,243	22,477	22,264	22,261
Wilsonville city	Oregon	15,514	14,893	14,085	14,042	13,991
Woodburn city	Oregon	22,147	21,220	20,266	20,203	20,100


www.ormap.org
Clatsop
Columbia
Washington
Tillamook
Multnomah
Hood River
Sherman
Gilliam
Morrow
Umatilla
Wallowa
Union
Yamhill
Wasco
Clackamas
Marion
Polk
Wheeler
Baker
Lincoln
Jefferson
Benton
Linn
Grant
Crook
Deschutes
Lane
Malheur
Coos
Douglas
Harney
Klamath
Lake
Curry
Josephine
Jackson

INTRODUCTION TO CLIMATE

Climate is the average of weather conditions in an area over a long period of time. To understand about elements that make up such weather conditions you should study the following facts.

The climate of a place can be studied by looking at the information on the temperature changes that occur there and the kind and amount of precipitation that is received there during a year. Can you describe the climate in the part of the U.S. where you live? Are the winters long and cold, or are they short and mild? Are summers hot, or are they cool? Does it snow often in the winter? How often and how much does it rain? Have you ever been in a part of the U.S. where the climate is different from yours? If so, how does it differ?

Because the climate is not the same in all parts of the U.S., the natural vegetation differs from place to place. The kind of natural vegetation in a place depends upon the temperature range and the amount of precipitation that is received.

TEMPERATURE VARIES FROM PLACE TO PLACE

Taken as a whole, average temperatures in the United States vary widely between the winter and summer months. The average summer temperature of the nation is higher than the average winter temperature. (This is not true in all parts of the world.) The southern states, however, usually have higher temperatures than the northern states during the summer months. The northern states usually have much lower temperatures than the southern states during the winter months.

PRECIPITATION VARIES FROM PLACE TO PLACE

Some parts of the U.S. receive large amounts of precipitation annually in the form of rain, snow, sleet or hail. Other parts receive only small amounts. You can see on the map of Average Annual Precipitation that the eastern half of the nation receives 20 inches or more of precipitation annually. Much of the western part of the nation, however, receives less than 20 inches of rain.

The precipitation an area receives depends mostly on the winds. When winds blow inland from warm water, they are quite moist, so places over which these winds blow are likely to receive large amounts of rain. For example, moist winds from the Atlanti Ocean bring large amounts of precipitation to the eastern half of the U.S. Within this area, the precipitation decreases toward the west. Why do you think this is so?

Mountain slopes that face the direction from which the winds come are windward slopes. Mountain slopes that face the same direction the wind blows are leeward slopes. When winds blow from off warm bodies of water against the windward slopes, the air is forced to rise. As the air rises, it cools and is less able to hold its moisture so these slopes receive much rainfall. The leeward slopes receive little rainfall since most of the moisture has been dropped. How does this explain why some parts of the western states are very moist and other parts are very dry?

REMEMBER THESE THINGS THAT INFLUENCE CLIMATE

1. How far north or south (latitude) 2. Wind 3. Ocean currents 4. Nearness to water 5. Altitude 6. Mountain barriers

Name ______________________

Date ______________________

Climate Graphs -- Worksheet

1. Use this data to fill in the attached climate graphs.

Portland	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Year Avg
High Temp	45.5	50.1	55.5	60.8	67.0	72.6	78.9	79.1	74.2	63.0	51.4	45.5	62.0
Low Temp	36.7	38.5	40.7	43.5	48.5	53.2	57.3	57.9	54.6	48.1	41.8	37.3	46.5
Avg. Temp	41.1	44.3	48.1	52.2	57.8	62.9	68.1	68.5	64.4	55.6	46.6	41.1	54.3
Precip	6.24	5.07	4.51	3.10	2.49	1.60	.76	.99	1.87	3.39	6.39	6.75	43.16
Elev. 575'													

Bend	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Year Avg.
High Temp	39.7	44.1	50.6	57.4	64.9	72.8	80.7	80.6	72.4	61.7	46.3	39.6	59.2
Low Temp	22.6	24.7	27.2	30.0	35.6	41.2	46.2	45.6	38.6	32.2	27.6	22.7	32.8
Avg. Temp	31.1	34.4	38.9	43.7	50.2	57	63.4	63.1	55.5	47	37	31.2	46
Precip	1.76	1.13	.92	.70	.90	.75	.62	.60	.49	.62	1.46	1.78	11.73
Elev. 3700'													

2. Find these places on a map. Compare their locations.

3. Answer these questions after you double check your climate graphs.

a. Which city is farther south? ______________________

b. How is the temperature of these cities affected by latitude?

____

c. Which city is higher in altitude? ______________________

d. How is the temperature of Bend affected by its elevation?

____

e. Which city is near a large body of water? ______________________

f. Which city has the least variation in temperature over the year?

____

g. Which city has a mountain barrier that affects its rainfall?

____

h. Which city receives more rain? ______________________

i. Which city has severe winters? ______________________

j. Which city has more rain in summer? ______________________

4. Use your maps and graphs to describe the climate of each city. USE COMPLETE SENTENCES.

____

____

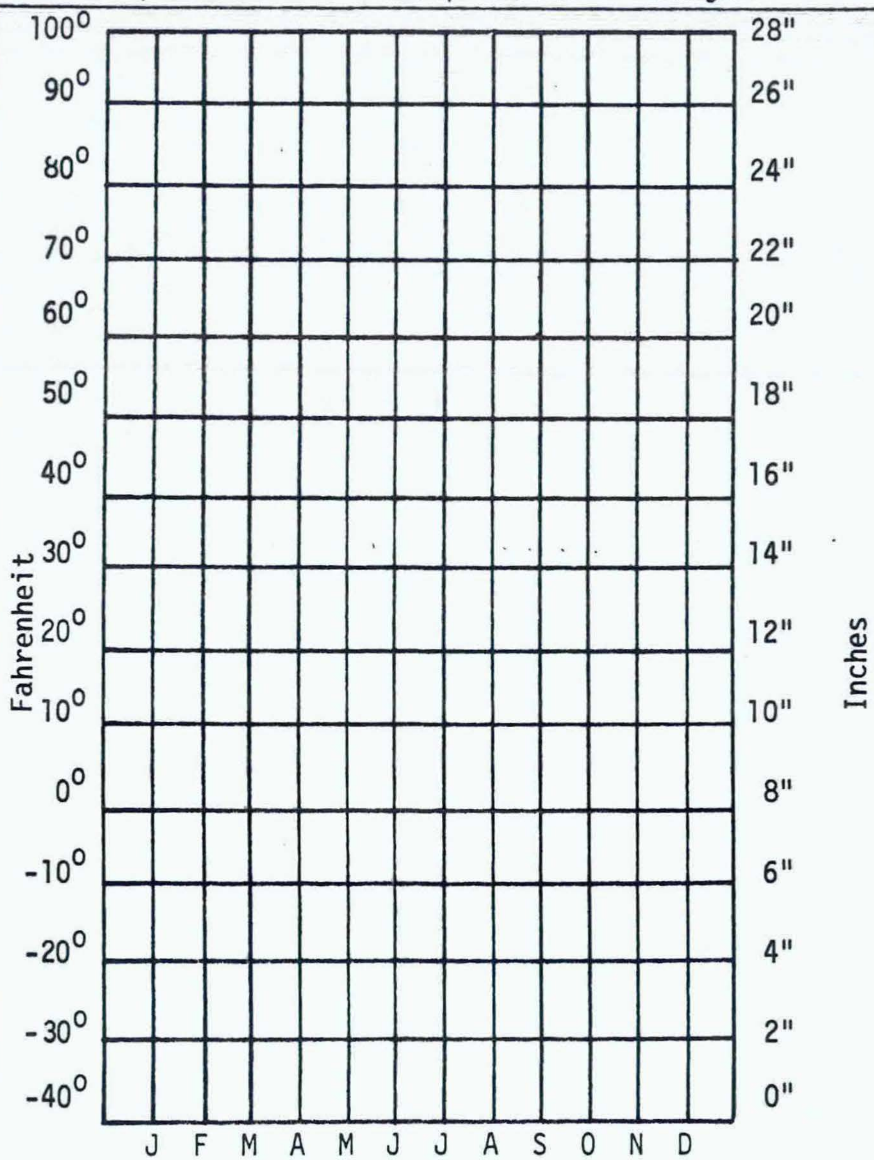
____

CLIMATE GRAPHS

CLIMATIC TYPE ____________________

LOCATION ____________________

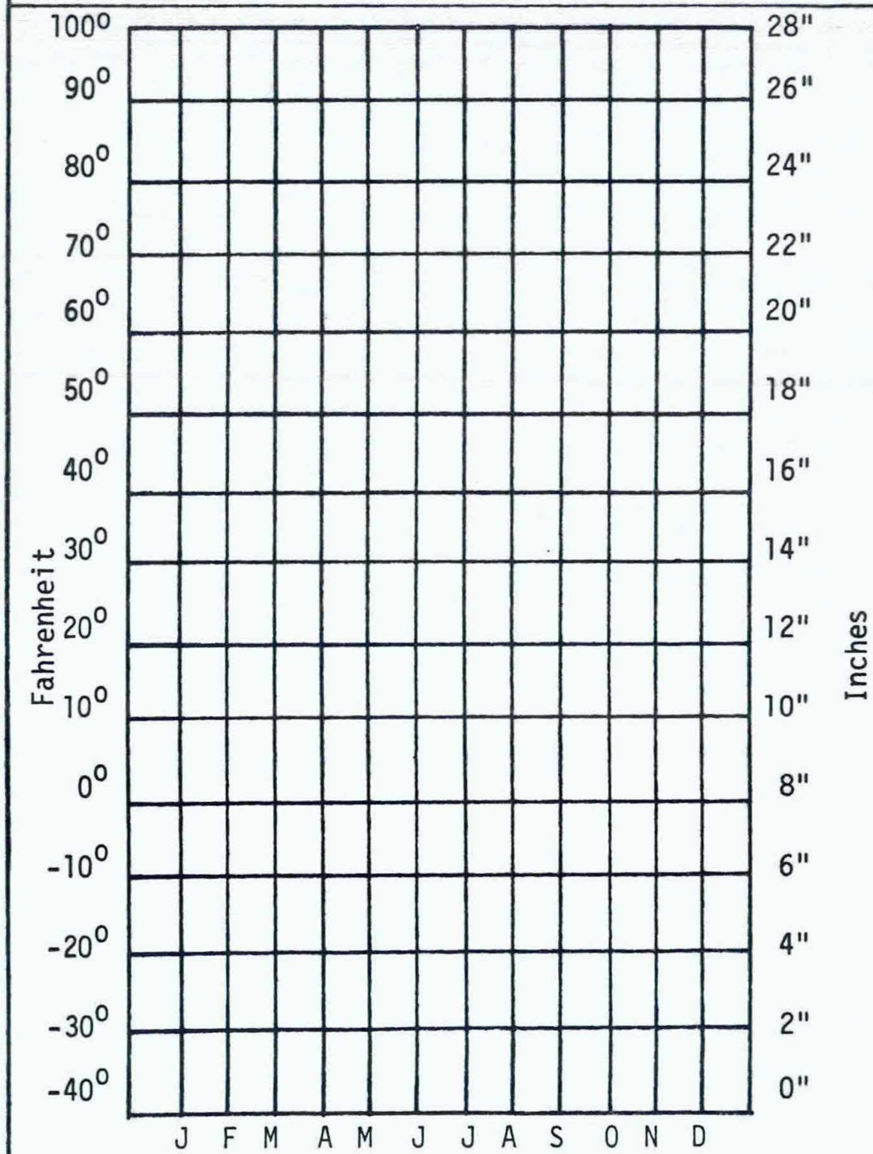
Average Annual Temperature | Average Annual Precipitation | Temp. Range



CLIMATIC TYPE ____________________

LOCATION ____________________

Average Annual Temperature | Average Annual Precipitation | Temp. Range



DAVID SOBEL

MAPMAKING WITH CHILDREN

SENSE OF PLACE EDUCATION FOR THE ELEMENTARY YEARS

Heinemann
A division of Reed Elsevier Inc.
361 Hanover Street
Portsmouth, NH 03801-3912
http://www.heinemann.com

Offices and agents throughout the world

Library of Congress Cataloging-in-Publication Data

Sobel, David, 1949–
Mapmaking with children: sense of place education for the elementary years / David Sobel.
p. cm.
Includes bibliographical references.
ISBN 0-325-00042-5
1. Map drawing. I. Title.
GA130.S6 1998
372.89'1—dc21 98–14641
CIP

Editor: William Varner
Production: Melissa L. Inglis
Cover design: Linda Knowles
Cover artwork: Craig Altobell
Manufacturing: Courtney Ordway

Pen and ink drawings throughout the book are by Cynthia Mathewson.

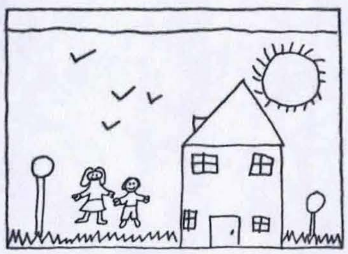
Printed in the United States of America on acid-free paper
02 01 00 99 RRD 2 3 4 5

Regardless of how young the children are, I always first ask for a map because I am interested in the developmental emergence of the "map concept." If children say, "You mean you want a helicopter view or a bird's view?" my response is,

> There are many different ways to draw a map. Any way you choose will be fine. Just try to figure out a way to show me your favorite places.

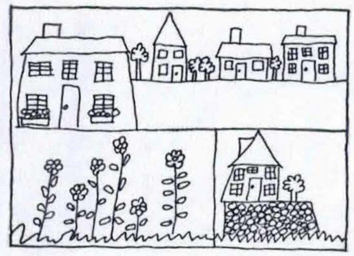
I provide the children with 15-by-22-inch paper, pencils, erasers and an assortment of crayons. I don't allow the children to use rulers, to encourage more naturalistic, freehand maps. Younger children tend to finish sooner than older children. When the children finish, I ask them to tell me individually about the places on their maps. At the end of each interview, I ask each child to select his or her "favorite place" in the neighborhood. In some of the interviews, the children discuss places that they have not included on the maps. I ask these children to create anextension of their maps, adding on another sheet of paper in the appropriate direction. This often leads me to some of the children's most interesting places.

I have conducted map interviews and field trips with children in Vermont and New Hampshire in the United States; in Devon, England; on Carriacou and Provodenciales (small islands in the Caribbean); and in Monteverde, Costa Rica. Colleagues of mine have conducted similar interviews with children in New York and Boston. Reviewing and analyzing these maps, I have observed consistent patterns of development that appear to be somewhat independent of environment and culture. In other words, there are some underlying patterns that are the same whether the



No Place Like Home
(Rebecca, 5 years old)

Scope: House and yard
Perspective: Pictorial
Attributes: Child's house central and large
People included
Sun and rainbows present
Lots of colors



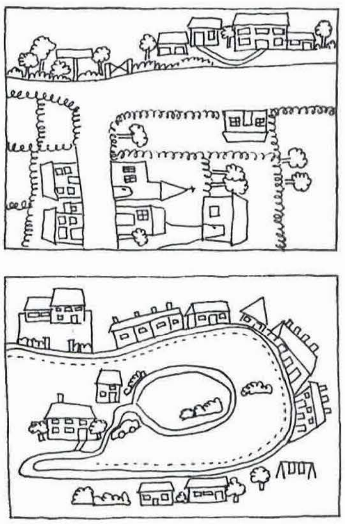
Out and About
(Matthew, 7 years old)

Scope: Immediate neighbors
Perspective: Slightly elevated (Low oblique)
Attributes: Two or three houses
Multiple baselines
Roads appear
Trees, paths, bushes

FIGURE 2–1 *The evolution of children's neighborhood maps from ages five through eleven. As children mature they move from pictorial maps of their homes to aerial maps of their communities.*

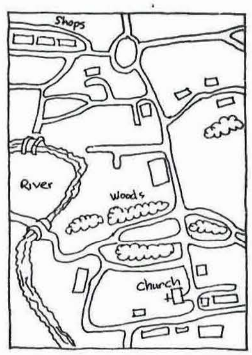
landscape is tropical and parched or temperate and moist. And black children in the Caribbean map their worlds in ways similar to white children in Devon. There are some cultural and educational variations, but there are enough similarities to presume that the unfolding cognitive solutions for making maps are biologically predetermined, much as language development is predetermined. Understanding these biological predispositions can give us a firm foundation for curriculum.

The maps in Figure 2–1 are re-creations of actual maps I have collected from children and show different stages of development. I find it useful to focus on two different aspects of the maps—the scope and the perspective. By *scope* I mean the size and range of the child's world, the life space. The core question is, How big is the territory covered by the map and what are the salient features illustrated? By *perspective* I mean the angle from which the child draws the map. The core question is, What vantage point does the child choose from which to look at his or her surroundings? I have chosen to focus on the maps of children who live in single-family dwellings to show the emergent pattern, but maps from children who reside in apartment buildings are similar in scope and perspective.



It Takes a Village
(Heather and Vivian, 9 years old)

Scope: Neighborhood/community
Perspective: 45° Elevated
(High oblique)
Attributes: Houses pictorial
Roads provide structure
Forts and hideouts are common
Legends often used



Up, Up, and Away
(Travis, 11 years old)

Scope: Nearby towns/region
Perspective: Aerial
Attributes: Houses disappear
Scale becomes accurate
Symbols replace pictures
Water courses connect

FIGURE 2–1 *Continued*

education curriculum, and it can give us insight into the cognitive changes that characterize the challenge of moving from kindergarten to sixth grade. Forcing the first or second grader to get in the driver's seat and steer is asking for trouble.

IMPLICATIONS FOR CURRICULUM

The point of this close examination of children's maps is to inform classroom practice, to bring curriculum in tune with biology. Right now, much of our curricular practice is discordant. The practice of premature abstraction creates inharmonious music that causes many students to stop listening. Rather, we want to give children simple instruments and accessible instruction so they can make beautiful musical compositions that start simply and gradually gain in complexity. To guide this training, I suggest some basic principles of the small-world approach to mapmaking that will underlie the hands-on suggestions for teachers.

Make Big Maps of Small Places

Currently, we do just the opposite. In that little book of continents that my first grader brought home, Australia was about four inches across. Atlases are filled with small maps of big places. The biggest map kids usually see is the map of the United States, the retractable one hung from hooks on the edge of the blackboard. This is the right size for a map, but the area depicted should be the school playground, or the walk from the school to the animal shelter. First maps for children should be big, bigger than $8^1/_2$-by-11-inch paper—as big as the desktop, as big as the tabletop. In fact, first maps should probably not be maps; they should be three-dimensional models.

Remember that Model Making Precedes Mapmaking

In his research with children, Roger Hart (1979) discovered that when children were given three-dimensional materials such as blocks, cut paper, small trees, and a toy car, they made far more accurate maps of their neighborhoods than when they drew them two-dimensionally. Especially in the primary grades, and sometimes in the intermediate grades, maps should be built and sculptured as much as drawn.

Honor the Expanding Horizons Progression

As children's maps increase in scope, so should the maps in the curriculum. Introduce maps of the desktop and sandbox in first grade, maps of the school and playground in second grade, maps of the city block around the school in third grade, and so on. It's true that children can understand maps of greater sophistication than they can make, but you should always maintain a developmentally appropriate mapmaking strand in the curriculum.

Use Pictorial and Panoramic-View Maps

Take a look at the map of the "100 Aker Wood" from *Winnie-the-Pooh* (Milne 1926). The perspective view is exactly like that used by eight- and nine-year-olds. In fact, look at the maps from *Treasure Island* (Stevenson 1997), *My Father's Dragon* (Gannett 1948), and *The Hobbit* (Tolkien 1966). They are all panoramic-view maps with pictorial enhancement. Authors and illustrators use this kind of map because they intuitively understand that these maps make sense to children. Yet we rarely use these kinds of maps as part of the curriculum. Encourage children to draw these kinds of maps and—here's the hard part—get used to mapping this way yourself.

Walk, Don't Run

We all have a tendency to want to skip over the necessary, incremental steps. Yet when children don't need to count on their fingers anymore, they will stop on their own accord. When it becomes cumbersome for them, they incline toward efficiency. Therefore, it is OK to linger at the early stages. For example, instead of submitting to the curricular charge to cover Vermont geography in fourth grade, focus more appropriately on the geography of Brattleboro. Field trips are much more affordable when you focus on what is local. Provide children with many substantive experiences of making maps of visible, accessible places. These will then serve as metaphoric bridges to understanding those smaller maps of bigger places.

Mapping Insects in Wooded Areas

Grid frames are well suited to mapping the presence of insect life on the forest floor. You should do a bit of prior investigating to determine promising areas before assigning this task to your students. It will also be important for your class to spend time—before or during this project—learning how to identify major classes of forest soil bugs. *Golden Guides* are suitable resources that can supplement more sophisticated insect guides for children. Have the children place the frame on a section of forest floor and gradually peel back, leaf by leaf or bit by bit, the material covering the soil. The style here should be that of an archeological dig, gradually excavating the top levels of duff in order to find the hidden insect life below.

Mapping Anthills

The small-world experience can be accentuated by having children map anthills. Find a sandy area without much vegetation and a number of active anthills. Support the grid on the corners using stones or bricks so it doesn't interfere with the ant activity. First have the children map the features of the area—the anthills, damp and/or dry places, weeds, cracks in the ground, and sticks. Once they have created a map of the area, give them observational tasks on other days. Ask,

> Can you observe routes that the ants consistently follow and show them on your maps?
> Do the shapes of the anthills and the entry locations stay the same or change from day to day?
> What happens if you push one of the anthills to the side? Do the ants rebuild it in the same place?
> What happens after it rains?

There's a general principle to extract from this activity as well. Having a base map of an area that changes will facilitate observation of and long-term commitment to the flora and fauna of an area. Mapping an area is often like staking a claim. The mapping energy expended by the children serves to get them invested in what happens here in the future. The anthills of today can become the conservation areas of tomorrow.

Mapping a Puddle

Puddle tracing

Mapping a puddle can be an easy introduction to the idea of contour mapping, or it can simply be another two-dimensional challenge. If you're doing this as a two-dimensional challenge, it's often a good first step beyond the drawing enlargement activity. Unless there are islands in the puddle, the whole challenge is just to accurately map the shoreline of the puddle—one squiggly continuous line. By adding stones or bucketfuls of sand to the puddle you can manufacture islands and add more dimension and small-world quality to this little water world.

of the depths of four inches into an enclosed circular form. If you've got a depth of three-and-a-half inches next to a depth of four-and-a-half inches, you know the contour interval of four inches must go somewhere between them. Similarly, if you've got a depth of four-and-a-half inches right next to a depth of two-and-a-half inches, you know that both the four-inch and three-inch contour intervals have to go between them. After you've completed the four-inch interval, do the three-inch one. This should completely enclose the four-inch interval, and so on. Unless you've got multiple deep

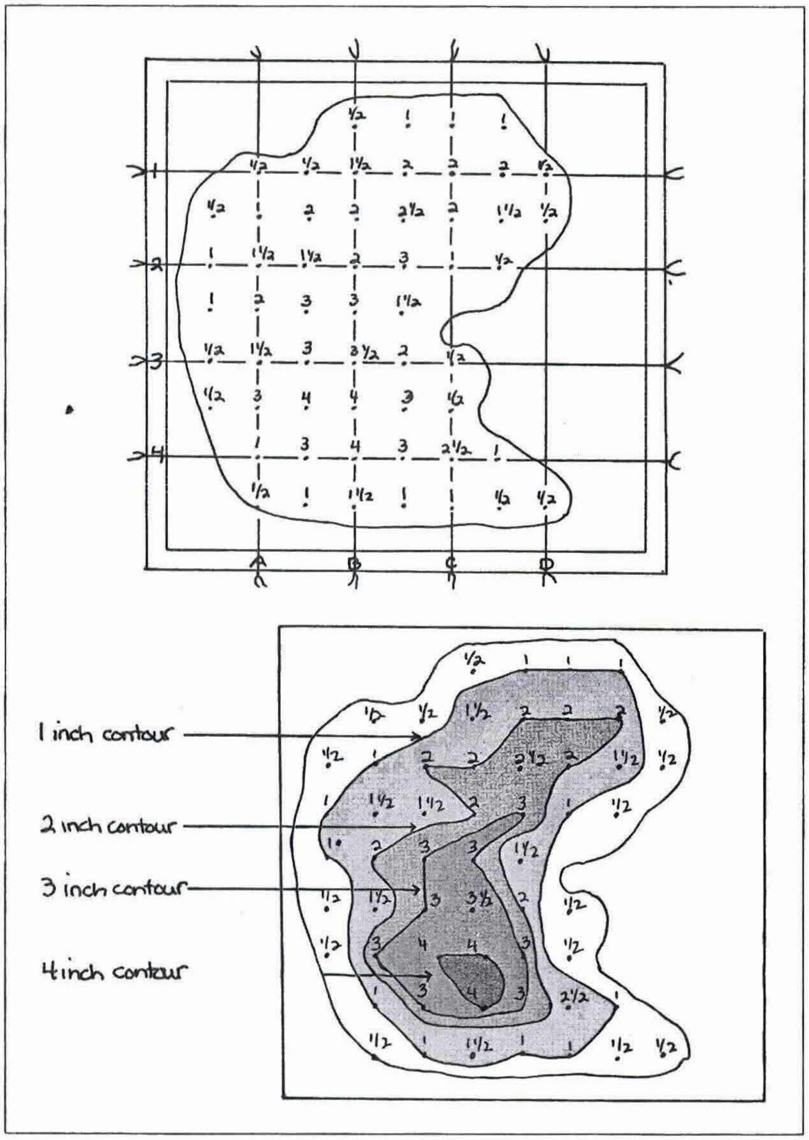
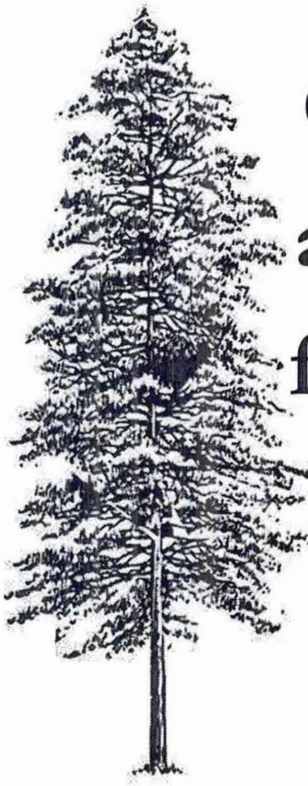


FIGURE 5–3
Outline map of puddle showing depth measurements and contour lines drawn from depth measurements.

Community as a Context for Learning

Curriculum of the Northwest Center for Sustainable Resources DUE #0101498
CHEMEKETA COMMUNITY COLLEGE



Community as a Context for Learning

Northwest Center for Sustainable Resources
Education for a Sustainable Future

Chemeketa Community College
Salem, Oregon
DUE #0101498

This project was supported in part by the **National Science Foundation**. Opinions expressed are those of those of the authors and not necessarily those of the foundation.

Lesson 5 - COMMUNITY ASSETS MAPPING

Objectives:
Students will be able to:
1. Produce a community map.
2. Articulate relationships between community resources.
3. Demonstrate careful data collection techniques.

Time needed: Three 45-minute class periods
Materials: Large butcher paper for wall map, community maps

Procedure

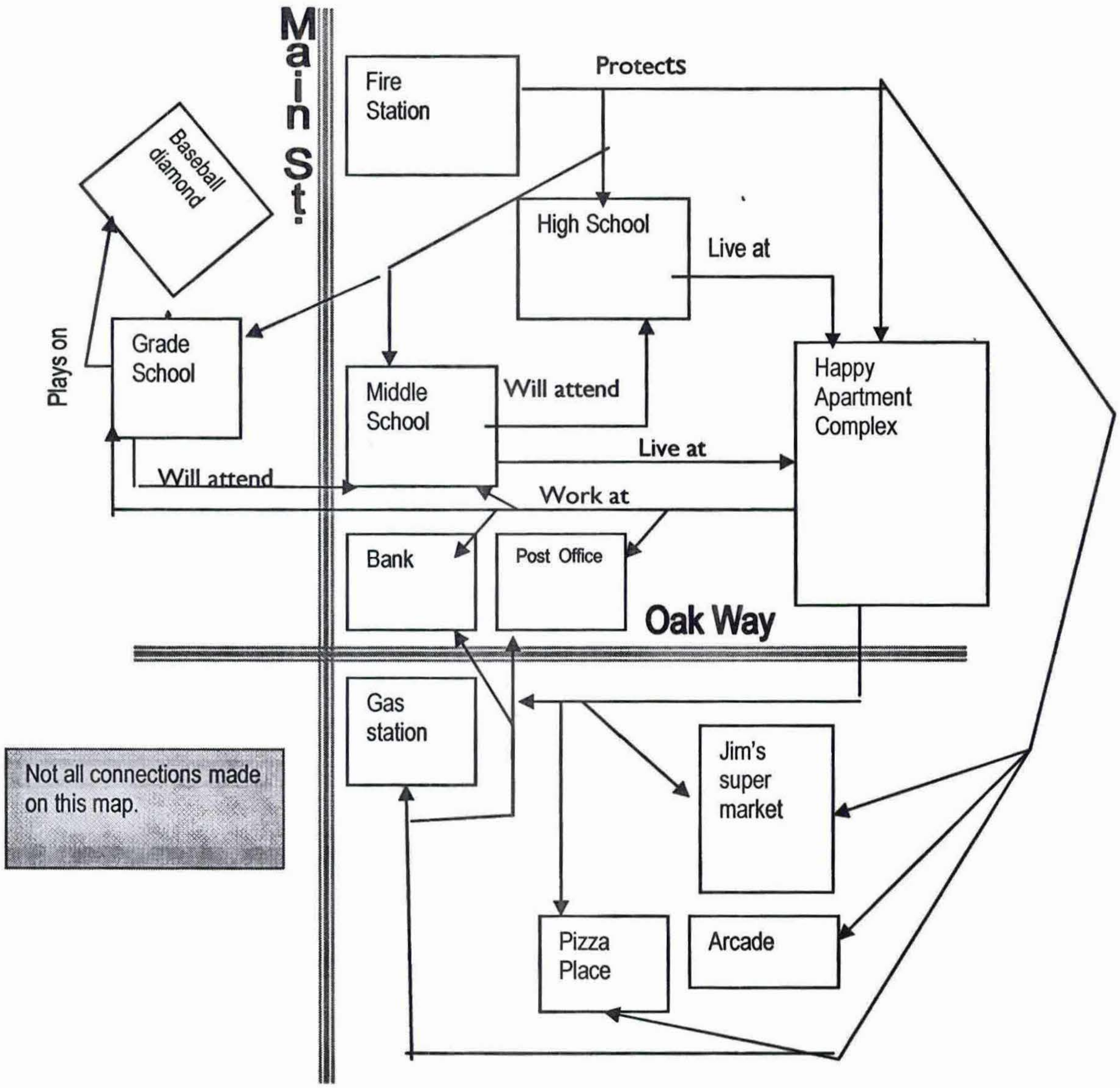
This activity can be used as an indicator of student awareness of their community. Students will create or obtain a large map of the community to put on the classroom wall or another visible location. Students can contact regional government offices, neighborhood groups or local tourist offices to seek out map donations. This map should not only include streets and schools but natural boundaries, commercial sites, greenspaces and demographic information; it might be easiest to make something that resembles a diagram more than a traditional map (*see following examples*). As students learn of new resources in their community, add them to or label them on the large map.

Relationships that the students discover between different community resources should be noted on the map as well. Students can use arrows and description boxes to illustrate the web of connections between the economic, environmental and social assets within the community.

Keep a tally of the number and nature of the entries added to the map each day/week/month. Some discussion questions may include:

- How did you discover the resources put on your map?

Step 2: Draw arrows showing how places are connected



Lesson 8 - WEB OF INTERDEPENDENCE

Objectives:

Students will be able to:

1. Identify economic, ecological and social components within a community.
2. Explain the concept of interdependence in natural systems.
3. Apply concept of interdependence to the surrounding community.

Time needed: One 45-minute class

Materials: None

Procedure

Every urban community can be viewed as a collection of the economic, ecological, and social components of the area. The community includes the systems in each of these three areas and the interactions between them. Allowing students to explore the extensiveness of this web of interdependence will help to highlight its significance.

In the same way that a community is a web of inter-connections, the elements of a natural ecosystem are interdependent as well. The changes that affect one part of the ecosystems will either directly or indirectly affect other parts of the ecosystem. A quick look at a food chain will help to illustrate this. Hand out the following student handout, *Ideas on Interdependence,* to discuss the food chain diagram and to record student answers for the following activity.

In order to examine interdependence in the community, allow each student to select a resource within the community. This can be an individual, a business, or a natural system for example. The assignment for each student is to then find three changes in the community (one social/civic change, one economic change and one natural/environmental change) that would affect his/her selected resource. For example:

- *A student would be affected if:*

    1. A new law changed school hours [social/civic]

Student Handout 8

Ideas on Interdependence

Parts of our community, just like parts of nature, are connected to each other in many different ways. If we look at a food chain that includes:

Willow Tree → *Leaf Beetle* → *Frog* → *Fish* → *Human*

We know that a drastic change in the population of any member will affect the populations of all of the other members of the chain. A natural event that decreases the number of leaf beetles would hurt the frog population by limiting their food source but would help the willow trees keep their leaves from getting eaten..

In order to think about interdependence in our community, you will select one part of your community and describe three different things that would change it. You can choose a person, place, business, a feature of nature, a school, or any other part of your community.

An example of this is:

- Community Resource: A student
- Social change: A new law that changed school hours would affect a student
- Economic change: A charge to use the Internet would affect a student
- Environmental change: Contamination of the town's drinking water would affect a student

Now, you need to select a different resource to complete the following:

1. Community resource I have chosen: ______________________________________

   ____

2. One social or civic change that would affect my resource: ____________________

   ____

   ____

3. One economic change that would affect my resource: _______________________

   ____

4. One natural or environmental change that would affect my resource: ______________

   ____

   ____

Planning a Community-based Project

Project Description

For Use In Exploring A Community-School Partnership

Community Organization: ____________________

Date: __________ Contact Name: ____________________

Tel: __________ Mailing Address: ____________________

____

E-mail Address: ____________________

Briefly describe the project your organization would like developed.

What *question(s)* or *issue(s)* does this project address?

What specific, tangible products could students help you develop?

How will the products or project results be used?

DATA

[ ] Existing data is available What data? ______________________________

____

Where is it? ____

[ ] Data collection required What data? ___________________________

____

How much? ____

Special data needs/concerns: __________________________________

____

____

When do you need different phases of the project completed?

Where is the project setting located?

Which disciplines would be involved?

[ ] Social/Cultural	[ ] Economics	[ ] Environmental	[ ] History
[ ] Mathematics	[ ] Life Sciences	[ ] Physical Sciences	[ ] Civics
[ ] Music	[ ] Geography	[ ] Physical Education	[ ] Reading & Writing
[ ] Visual Arts	[ ] Communications	[ ] Foreign Language	[ ] Technology

[ ] Other ______________________ [ ] Other ______________________

[ ] Other ______________________ [ ] Other ______________________

What are the benefits to your organization from involving students in your work?

3rd workshop

Ecological Teacher Training Series – Science Inquiry and Water Systems

Agenda

9:00 – 9:30 **Welcome, Agenda, and Reintroductions**

9:30 – 10:00 **Introduction to our local water system – Briggy Thomas, Water Bureau (tentative)**

10:00 – 10:30 **How to bring water systems into your school yard?**

10:30 – 10:45 **Break**

10:45 – 12:00 **Water Testing and Outdoor Protocol**

12:00 – 12:30 **Lunch**

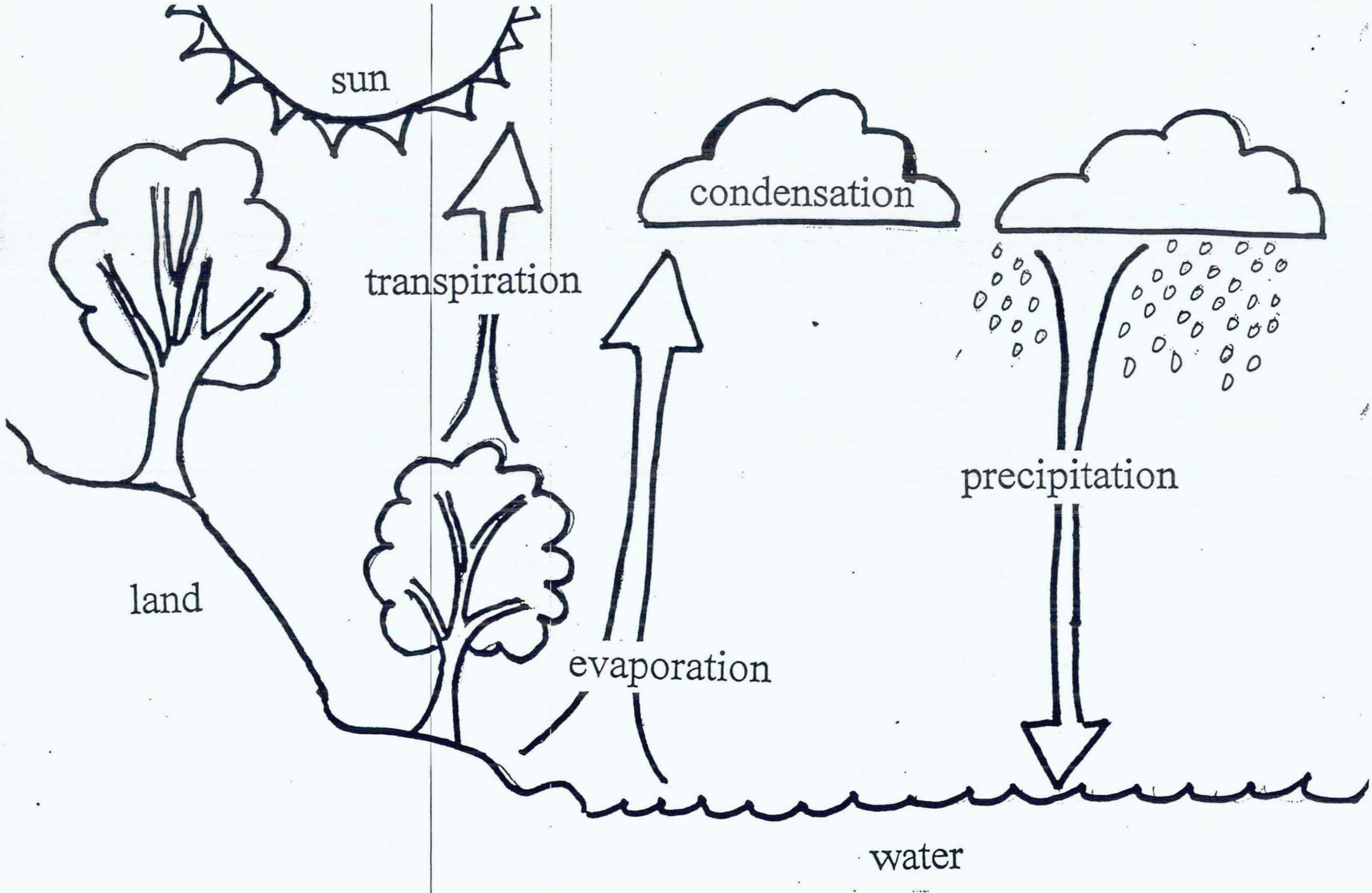
12:30 – 1:15 **Service Learning Projects at your school – Lynn VandeKamp, BES (tentative)**

1:15 – 1:25 **Break**

1:25 – 2:30 **Macro Invertebrates and Sampling Techniques – Xerxes Society (tentative)**

2:30 – 2:50 **Curriculum Mapping**

2:50 – 3:00 **Closing and Evaluation**



The Water Cycle

The Hike to the Stream:
On the way to the creek, each group should make one stop along the way to look at the forest. Discuss how the rainwater is absorbed into the soil, and what happens when the soil becomes saturated. Have them think about how the forest absorbs the water. How does the water make its way into the creek?

At the Stream: (do stream activities in any order)
Have students take a close look at the creek and compare its components to the components they included in their creek models. They can draw a picture of the real creek on their data sheets. If time allows it is also fun for them to test the water quality. Remember that their ability to comprehend abstract concepts such as parts per million, and the chemistry of a water molecule is limited. Ask students if they remember the three "C's" that creek critters need their home to be. COOL, CLEAN, and CLEAR. Explain that you are going to check the creek for some of these things.

pH:
Explain that we test pH to find out how acidic the water is. It helps us to know how CLEAN it is. Ask them if they can think of anything they know of that is acidic (such as a lemon or orange). Explain that the opposite of acidic on the pH scale is basic or alkaline. Things like soap and bleach are usually basic. Distribute the pH strips, and explain that they'll be comparing the colors to the charts. Have the students each dip their pH strip into the water sample. Choose one to compare to the color chart. Used strips should be collected to bring back to the Nature Center and throw away.

Temperature:
Ask students what they think affects temperature. Have students look around the riparian zone and identify things that might affect the temperature of Tryon Creek directly. Do they think it is COOL enough for fish? Use the thermometer to test the temperature.

Dissolved Oxygen:
Ask students if they remember what rapids and riffles give to the water(Oxygen). Ask them to note if they see any bubbles. Bubbles usually mean that oxygen is getting into the water. Explain that you will be using chemicals to test the DO level, and go over safety considerations. Show them the vacuum tube and explain how the tube works. Then explain how the chemicals react with the water to tell us how much oxygen is dissolved in the water. Do the test and compare to the kit to find out if there is oxygen for the fish to breathe.

Before you leave the creek, if they've seen any creek wildlife. Perhaps they can include any wildlife they've seen in their pictures. Gather group together for the return hike to the center.

WHAT MAKES A HEALTHY STREAM?

- **Clean Water**

  In order to be a healthy stream habitat, the water must be free of pollutants. These pollutants may include heavy metals like aluminum, cadmium and magnesium, toxic substances, and radioactive materials. Other pollutants such as man-made fertilizers and pesticides are known as volatile organics. All of these pollutants are dangerous to plants and animals that use the stream, and can harm or even kill them.

  The health of the stream habitat also depends on the amount of sediment that is flushed into the waterand builds up on the streambed. Silt on the streambed smothers and chokes out life on and under the rocks. This includes insects and fish and amphibian eggs.

- **Dissolved Oxygen**

  Dissolved oxygen occurs whenever the surface of the water is disturbed by rainfall, waterfalls, rapids, riffles, etc. The amount of dissolved oxygen in the water is important for both aquatic life and the breakdown of natural materials (decomposition). The level of dissolved oxygen in the water is influenced by the water temperature, the degree of disturbance of the water, and the amount of oxygen-demanding waste present in the water. The process of breaking down these natural materials requires high amounts of dissolved oxygen. As they consume the oxygen in the water, the dissolved oxygen level goes down, and this leaves less oxygen for aquatic life to consume.

- **pH**

  The acidity or alkalinity present in the water has important consequences for the health of a stream. Most fish species can tolerate a pH range between 6 and 8.5, and Tryon Creek has a pH of 7.5 (reading taken 7-18-96.) PH levels outside of this range are hazardous to aquatic life. PH levels are determined by soil type, bedrock characteristics and other natural and unnatural substances.

- **Temperature**

  Cool water temperatures are essential for a healthy stream. Warm water, in conjunction with other factors, can decrease the survivability of fish and fish eggs. Warm water can also increases the prevalence of disease and may change spawning and migration patterns.

- **Physical Features**

  Gravel Beds

  Gravel beds in the bottom of the creeks are important for spawning. Fish eggs require oxygen for survival.Fine sediments that fill the intergravel spaces reduces water flow to the eggs and thereby reduces the amount of oxygen reaching the eggs.

  Large Woody Material

  Logs, rootwads and woody debris are important for providing cover and shade for fish. They also form pools, trap sediments and retain spawning gravels.

  Other Debris

  Rocks, streambanks and dams also provide cover and sediment control.

  Vegetation

  Vegetation along stream banks are important for maintaining cool water, holding soil in place, and providing food for stream life.

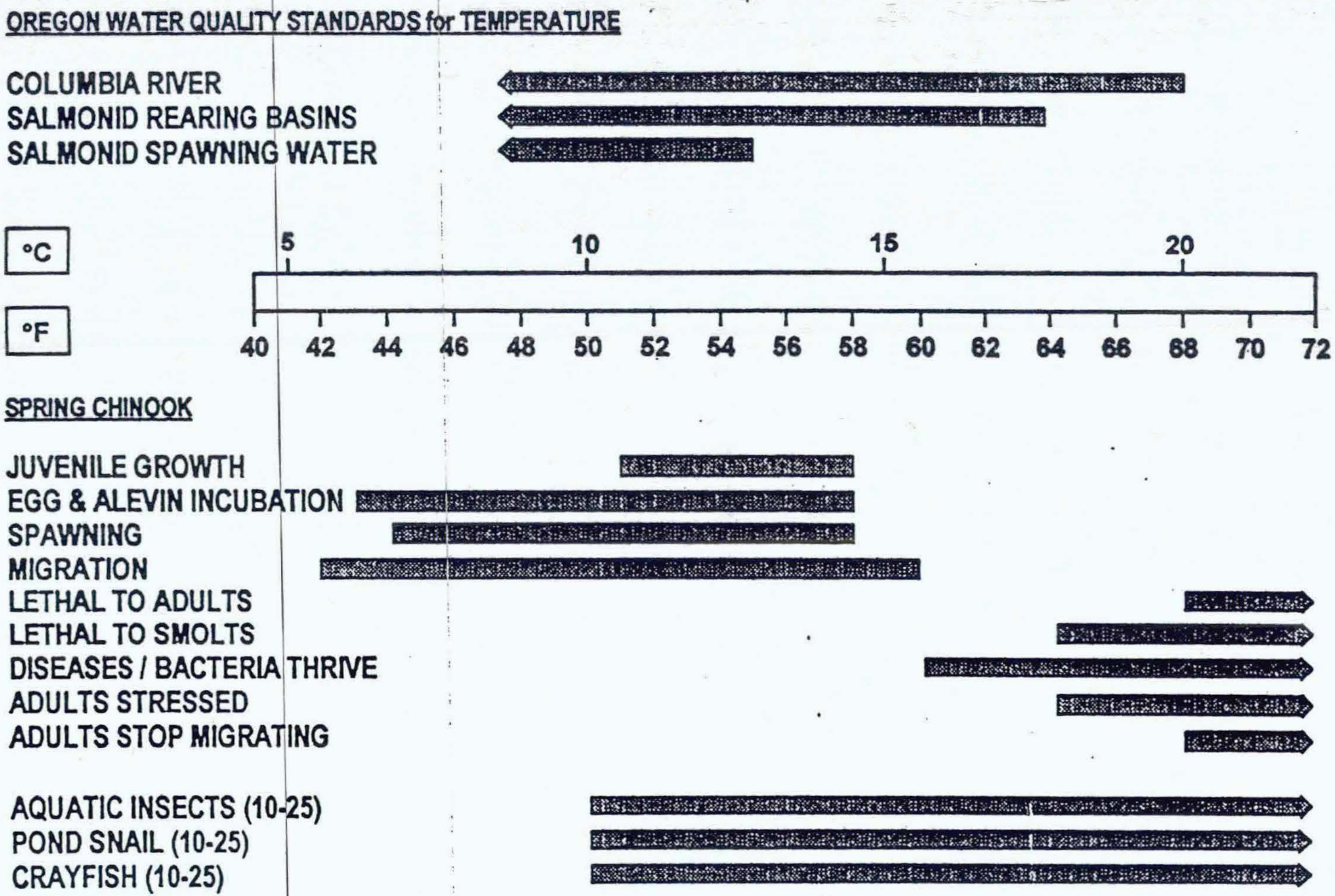
Aquatic Life in Tryon Creek

Fish
cutthroat trout
steelhead salmon - anadramous (ocean migrating)
sculpin (bottom feeders)
Pacific lamprey

Macroinvertebrates
crayfish
mayflies
caddisflies
craneflies
blackflies
aquatic worms
scuds
riffle beetles
water striders?

It is rare to find macroinvertebrates in Tryon Creek. Why?

* need for cold water. Human impacts on the creek - run off from homes and activities near the creek. For example, during breeding season for macroinvertebrates, in the summer, a summer rain will wash over the hot paved surfaces, and run into Tryon Creek, throwing dynamics of the creek off. .
* unnatural discharge from cars and fertilizer
* tree removal, again effecting the temperature of the creek.
* kids - turning over the same rocks at the access points. Critters up and leave, or are killed.
* dogs - creating disturbances to the stream and increasing the siltation problem.
* the natural gradient of the creek. Flow doesn't naturally give many opportunities to increase the level of dissolved oxygen necessary for these critters.



OPTIMUM TEMPERATURE LIMITS FOR AQUATIC ORGANISMS

Compiled from Stream Scene, Streamkeepers Field Guide, DEQ Administrative Rules, Aquatic Project Wild, Investigating our Ecosystem

Trout requirements

Temperature: The best temperature for trout is less than 12 degrees Celsius, (about 55 degrees Fahrenheit), although they have been known to survive within a range between 42 and 77 degrees F (5.6 and 25 degrees C). At 5 degrees C (41 F), trout use about 50 - 60 mg. oxygen per hour; at 25 C (77 F), they may need five or six times that amount. As fish are cold blooded, they use more oxygen at higher temperatures when their metabolic rate increases.

Dissolved Oxygen: Healthy trout habitat requires between 7 - 12 parts per million. Several studies suggest that 4-5 parts per million (mg/L) of DO is the minimum amount that will support a large, diverse fish population. The DO level in good fishing waters generally averages about 9.0 ppm. When DO levels drop below about 3.0 ppm, even the tough fish die. For percent saturation, 125% or more is too high - it may be dangerous to fish. 80 - 124% is excellent, 60 - 79% is okay, but not great, and below 60% is poor, for the water is too warm or bacteria are using up precious oxygen.

pH: Most fish can tolerate pH values in the 5.0 to 9.0 range, but 6.5 to 8.2 is the best water for aquatic life. A pH of 3.8 is the minimum pH for fish eggs to hatch, but the young are often deformed. 10.0 is the maximum pH for fish eggs to hatch, but again the young are often deformed.

Habitat requirements: Ideally, a healthy trout stream contains 40 - 60 % pools, a 1 - 20 foot gradient, lots of woody material to trap gravel and slow the stream velocity, boulders to help create pools, and undercut banks. Pools provide resting spots and protection for fish and undercut banks provide protection and cover as well as shade, although if too many pools exist there is less reoxygenation of the water and little area ideal for spawning. The creek requires shade to prevent a mid-day temperature increase. Riffles help increase the DO of the stream, for the water runs quickly over gravel and cobbles. Fish spawn in shallow riffles where well oxygenated water can provide oxygen and remove wastes. However, higher stream velocity can tire a fish, especially a young fish that is not large enough to fight the current. Too much silt deposited over spawning gravel can deprive developing eggs of oxygen rich water that normally percolates in the spaces between the pebbles.

Water Quality Monitoring

Name________________________________**Date**_________________

Site location____

Dissolved oxygen (DO)______________ ppm or mg/L

PH: Water _________ Sample 1 _________ substance_____________

Sample 2_________ substance_____________

Air Temperature _____________F_______________C

Water Temperature ____________F________________C

Turbidity_________________ JTU

Stream Morphology

Draw a picture of the creek.

What is the percentage of tree canopy shading the stream?_______

WHERE THE RIVER RUNS - THE CREEK ENVIRONMENT

Where does Tryon Creek begin? Where does it end? And what happens to it between these two points? The first two questions are relatively easy to answer. However, even an expert would have trouble answering the third.

WHERE DOES TRYON CREEK BEGIN? Tryon Creek originates as a series of springs and seeps in the hills near the park. These trickles merge to form small seasonal, year-round tributaries. Tryon Creek first appears as a blue line on most maps near Marshall Park in Southwest Portland. From there the creek flows southeast through private property until it enters the park just north of Boones Ferry Road. Near this point the flow from a major tributary, Arnold Creek, joins Tryon Creek to form the main stream through the park. Several tributaries add more water to the creek as it flows on its two mile journey through the park.

Tryon Creek has cut a ravine through the soft rock and soils that make up much of the park. Winter is a good time to observe the creek at work, for heavy rains cause the water to run swift and deep. The torrent carries gravel, silt, and tree branches along with it, scouring the creek bottom and eroding its banks.

The creek's relentless flow over many centuries has cut the 200-foot deep ravine that we hike through today. The tributaries continue to cut their own ravines as well. This results in a lot of up and down hiking especially on the Cedar Trail.

WHERE DOES TRYON CREEK END? The Willamette River is the destination for Tryon Creek. Large pipes under State Street (Highway 43) carry the water back onto private property. From here the creek flows past the Tryon Creek Wastewater Treatment Plant into the Willamette. The creek has flowed less than ten miles from its origins to its destination.

WHAT CAN YOU DISCOVER ALONG THE CREEK? A good location to view the environment along Tryon Creek is to walk the Middle Creek Trail between High Bridge and Beaver Bridge.

At High Bridge, Tryon Creek takes on its typical appearance through the park: a sluggish, meandering stream with dense forest vegetation growing to the water's edge. The muddy banks are steep in places and quite slippery. For your safety, do not climb down these embankments. Use the designated walkways next to most of the bridges that span Tryon Creek.

As you start walking toward Beaver Bridge you are in the creek's narrow floodplain. This area rarely floods and as a result, forest trees and shrubs are reclaiming this flat location. Note the red alder trees with their mottled grayish white bark. The common spiny shrub growing along the trail here is salmonberry.

The next major feature you encounter on your walk is a boardwalk that spans a boggy section of trail. The water table is at or near the surface here and the soil stays damp year-round. Plants associated with wet soils thrive here. Skunk cabbage, with its huge green leaves and pungent yellow flowers is a good indicator of soggy soils.

Beyond the board walk Middle Creek trail veers away from the creek. Typical forest trees such as western red cedar and western hemlock grow along the trail.

As you approach Beaver Bridge the tangle of vegetation that lines the creek becomes evident. Shrubs such as red elderberry and salmonberry thrive in the sunlight and damp soils. This dense growth make walking along the water very difficult. Please remain on the designated trails.

Along and within the creek live a variety of animals. Aquatic insects and crayfish hide under rocks and submerged tree limbs. Frogs and salamanders hunt for food in the dense undergrowth next to the water. Great Blue herons and raccoons search for crayfish and tadpoles in the sluggish water. And beaver cut down streamside alders for food.

During its brief passage, Tryon Creek has shaped the land, watered shoreline plants, and provided food and shelter for aquatic wildlife. And finally, the creek has given this popular state park a beautiful focal point!

GEOLOGY

Tryon Creek State Park lies in the northern part of the Willamette Valley, south of Portland and just north of the city of Lake Oswego. Many millions of years and a multitude of geologic events have created the landscape of the park and its adjacent land. There are a number of major geologic events that have given shape to the present Willamette Valley and the Portland basin including Tryon Creek State Park. These geologic processes included volcanoes, faulting, folding, earthquakes, and catastrophic flooding. The geology of the park is just a small part of the overall picture of the area. This history began millions of years ago.

Approximately 40 million years ago a land mass of volcanic origin lay off the Oregon coast. At that time the ancient sea shore lay very close to the east part of what is now the Portland basin. The land lay submerged until about 28 million years ago when it was elevated above the water. It was a relatively flat terrain and it consisted of volcanic flows and associated sediments containing fossil sea creatures. Subsequently it was much eroded. It is known as the Waverly Heights Formation. This formation is considered to be part of an oceanic island that was rafted on an oceanic plate millions of years ago and accreted to the North

American continent now exposed in Tryon Creek State Park. The theory of plate tectonics assumes that the lithosphere is broken into individual plates that move in response to convection currents in the upper mantle. The formation is exposed in most of the park proper and some areas surrounding the park including Waverly Heights on the east side of the Willamette River. It was in place before the next period of major volcanic activity, that of the outpouring of the Columbia River basalts.

About 15 million years ago the Columbia River basalts began to spill out of huge cracks in the earth near the Idaho, Washington, and Oregon border. These basaltic flows spilled over much of southwest Washington and continued flowing into the northern part of Oregon. Some of the early flows followed the early course of the Columbia River which dumped into the ocean near Salem, Oregon. Successive flows of the basalts filled in some of the channels of the Columbian River moving it further and further north to its present location. The basalts flowed around the Waverly Heights basalt, but did not flow over the top. This is why the park is composed mostly of Waverly Heights basalt, but did not flow over the top. This is why the park is composed mostly of Waverly Heights basalts. There were many Columbia River basalt flows. Between some of the flows there were thousands of years for erosion to take place, forests to grow, lakes to form before the next basalt flows covered them up. Evidence for this is in the petrified wood, tree casts, and other plant material found between some of these layers of basalt. A number of tree casts can be seen 1000 feet east on the north side of Highway 205 at the West Linn wayside. Close to the south end of Tryon Creek State Park where Terwilliger and State streets meet, there is a tree cast at the base of the cliff. In some places lakes were formed in depressions. In other instances the products of weathering of the lava rich in iron collected in these lake beds. There were 14 flows of Columbia River basalts in the Portland basin. The basalts are about 1000 feet in thickness. The most common rock in the Lake Oswego area is Columbia River basalt with the exception of the Waverly Heights basalts of the park. These Columbia River basalts are assigned to the Miocene Epoch.

The Pacific Plate diving under the North American Plate caused the Coast range to arch up with the Portland Hills. This caused down-folding of the Portland-Vancouver-Tualatin Basins including the land which is now Lake Oswego. The east side of the upfold was dropped due to the Portland Hills fault at this time. As the Portland Basin was dropped lower and lower by the action of the fault, a large lake formed and the Columbia River dumped first mudstone and later gravels into it building it up to a depth of 1725 feet. A later period of deposition, the Troutdale Gravels, was dumped into this basin up to an elevation of 625 feet. The Troutdale Gravels contained a percentage of rocks called quartzites. Some gravels containing quartzites came from British Columbia. The quartzites are metamorphosed quartz sand, like white beach sand. In some places the quartzites make up 30% of the gravels. Exposures of these gravels can be seen on the sides of the Mt. Tabor cinder cone, up Cornell Road just before the road inters the first tunnel, and good exposures can be seen along the lower Sandy River several miles south of Troutdale. The late Dr. Stauffer, Professor a t Lewis and Clark College indicated seeing Troutdale Gravels in a lower stretch of Tryon Creek in the park.

A number of other faults developed during this period. The Lake Oswego fault goes through the lake of the same name. The Iron Mountain fault parallels the Iron Mountain Road close the Hunt Club. A number of homes are built on the edge of the fault scarp. The faulting here caused the south side of Lake Oswego to be dropped several hundred feet. The Oatfield-Terwilliger fault follows along Terwilliger Boulevard on the east side of the park. Another small fault cuts across the southern end of the park.

Some 2 million years ago more volcanic activity took place and these volcanoes are called the Boring Lavas. There were many of these small volcanoes dotting the skyline between here and the area around the town of Boring, Oregon. Two in the vicinity of the park are Mount Sylvania and Cook's Butte. These two volcanoes are similar to Mount Tabor and Mount Scott on the east side of the city. These produced lava flows and some ash. A Mount Sylvania flow entered the western edge of the park and lies on the Waverly Heights formation and the Columbia River basalts. The Boring Lavas were named by a geologist, Ray Treaher, for a cluster of vents close to the town of Boring, a few miles east of Portland. There are many of these vents close to the Portland-Lake Oswego area including Rocky Butte, Mount Scott, Kelly Butte, Highland Butte, and Mount sylvania to name a few. Cook's Butte which is closest to Lake Oswego dates back 1.3 million years. Tryon Creek State Park is unique in that this small area of the park and land extending under Lewis and Clark College down to the Willamette is a different kind of rock, 26 million years older than the rest of the rock in this area.

The most exciting geologic period for the park and Willamette Valley was the Ice Age beginning some 3 million years ago and ending around 12,000 to 10,000 years ago. Within this 3 million years of time the continental glaciers covered about 55% of North America. There were mountain glaciers in the Cascades. The continental and mountain glaciers went through times of retreating and expanding. About 12,000 years ago, a lobe of the continental glacier plugged the Clark Fork River in Montana forming a huge lake called Lake Missoula. Successively the lake would fill with many cubic miles of water before being released, The Bretz Floods, so named because they were described by geologist J. Harlen Bretz, occurred during the last 2,000 years of the Ice Age. A tongue of the ice sheet plugged the Clark Fork River and released the water about every 55 years. It has been estimated that there were a least 40 floods and possibly as many a 100. When the dam broke the water rushed over southeast Washington, down the Columbia River through the Wallula Gap toward the Portland area, and up the Willamette River to Eugene. At times it ran into barriers such as ice jams that would cause the water to pond into large lakes. One such lake was Lake Allison in the Willamette Valley. The water in the Portland-Lake Oswego-Tryon Creek area was about 400 feet above sea level. This meant that Lake Oswego was under about 200 feet of water and the park was under about 100 to 150 feet of water. The rushing water came over the land of Tryon Creek State Park and scoured the land including everything that was loose down to the basalts of the Waverly Heights Formation. Other places, as the force of the water slowed down, it would drop its load of debris to form blockages or debris dams. An example of this type of blockage is the debris that blocked the Tualatin River and changed its course so it entered the Willamette River some 6 miles further south of its original course. Before the Bretz Floods the Tualatin River flowed through what is now Lake Oswego. As the water rushed through this area it widened the valley and created the Lake Oswego lake bed.

Between and after the great floods there were long dry periods. The fine sediments deposited in the Portland basin were then blown around by these dry winds. This left deposits of fine silts on the surrounding lands, but with each successive flood the loose sediments on the hill were washed away. Remnants of these sediments are still on surrounding hills above where the flood waters flowed.

Since the Ice Age Tryon Creek has helped cut down through the Waverly Heights volcanics to provide many habitats for plants and animals. The history of geology is not finished in the park, it is ongoing.

CLIMATE

Climate is the sum of all the weather elements affecting a particular location: wind, temperature, and the amount and distribution of precipitation. The microclimate of an area is all of these with the additional influences of vegetation orientation and slope. Tryon Creek's overall climate is similar to the rest of the Portland area's. However, its unique location, dense forest canopy, and water sources contribute to a distinct microclimate that dictates the kind of plants and animals that thrive in the park.

The temperatures at the park are quite mild. The average summer-winter temperature range is a July maximum of 80 degrees F and a January minimum temperature of 33 degrees F. Visitors enjoy escaping the summer heat while taking a walk in the shade of the forest or enjoying a picnic in the shelter.

The average growing season is a little over 200 days with dry, moderately warm summers and wet mild winters. Measurable precipitation falls about 160 days a year. This results from frequent storms that move in from the Pacific Ocean in the winter, and occasional showers and even a stray thunderstorm in the summer.

Each season offers a special beauty to the visitor.

The Tryon Creek watershed receives an average of about 40-45" of moisture a year; with 70 percent falling from November through March and an average 5 percent from June through August. In some years, no precipitation falls for a period of 30-60 days during the summer. You will notice the effect of this on the creek as you walk along the trail and cross over the bridges. If there has been considerable rain, please check the bulletin board as you enter the park for trail conditions.

Despite the protection from the Coast Range, Pacific storms can occasionally generate winds of considerable strength at Tryon Creek State Park. This occurs from October to April with winds of sustained speeds of 40 to 50 miles per hour during most years. During the Columbus Day storm of 1962, winds in excess of 70 miles occurred throughout the Willamette Basin. As you walk through the park you will notice trees that have been blown down by strong winds.

Marine air often covers the Willamette Valley bringing morning clouds or fog. The summertime high sun-angle brings sufficient solar energy to evaporate the clouds for pleasant, sunny afternoons. The east winds in this area influence our coldest and our warmest temperatures. They can bring bitterly cold air to this area in the winter and hot, dry air in the summer. During a east wind condition in the summer, the humidity usually drops to 15-20 percent causing a high fire hazard. We appreciate your help in keeping the park a fire free zone.

SOIL

Soil is composed of layers of stone, sand, and clay which has been worn away by the elements and living things. Scientists say that soil is a collection of natural bodies which has been synthesized in profile form from a mixture of broken and weathered minerals and decaying organic matter. This mantle covers the earth in a thin layer, which supplies support and sustenance for plants. Soil is made by the action of water, wind, glacial action, and acids produced by pioneer plants such a liverworts, mosses, and lichens.

The way a soil feels to the touch is one way of determining the kind of soil you have around you. Clay soils feel very slick and tend to make a ribbon when pressed or rolled between your fingers. Silt has a floury or talcum powder feel when dry and is only slightly sticky when wet. Sand particles feel gritty to the touch.

The soil in Tryon Creek State Park has a very hard clay layer, fragipan, 24" under the surface. Most tree roots and water cannot penetrate this hard clay layer. During the winter this makes the ground very wet and unstable. When a strong wind or ice storm strikes the park after a rainy period, many trees lose their grip in the wet, shallow soil and fall over.

The upper soil layer in the park is rich in humus. This dark colored mulch contains the decaying remains of roots, leaves, and other plant materials. Many animals live in this soil layer, and their activities such as eating, tunneling, and excreting enhance the decay process which in turn speeds the flow of nutrients to the roots of living plants. Thus, the forest recycles its nutrients through its blanket of soil.

DISSOLVED OXYGEN

Introduction:

The amount of dissolved oxygen present in water (DO) is an important factor in determining the health of a stream. DO is measured in milligrams per liter, mg/L, which means that there are "X" milligrams (mg) of oxygen present in every one liter of water. This is equivalent to parts per million, ppm, which means that there are "X" oxygen molecules present for every million water molecules. In addition DO can be measured as the percentage of saturation, for example 100% oxygen is equal to 100% of the oxygen in the air, which is 21% of all the elements in the air.

The oxygen in water comes from two main sources: 1) the air around the water by means of waterfalls, waves on lakes, and fast moving water in rivers and streams. 2) when the sun is out, algae and other rooted aquatic plants release oxygen in the water by photosynthesis. Photosynthesis is a process where carbon dioxide and water are used by the plant with the sun's energy to produce oxygen and sugar.

Aquatic plants and animals need oxygen to survive. Fish breathe the oxygen in the water through their gills. When there is no light available plants take oxygen out of the water in a process called respiration and produce carbon dioxide. Water with DO levels that are regularly high are usually healthy and can support a wide variety of plants and animals. Low DO levels may indicate a water quality problem. The Oregon water quality standard is 7 mg/L (same as 7 ppm) for water used by anadromous (fish that return to their stream of birth to lay eggs) and resident fish. The average dissolved oxygen level for good fishing is 9 mg/L. Studies show a DO of 4 - 5 mg/L is the minimum amount that will support a large, diverse fish population. Levels less than 5 mg/L lead to mortality in anadromous fish species.

Organic waste is a type of pollution that can have a major effect on DO levels. Organic waste is material that was part of a plant or animal including leaves, twigs, food, sewage, and fertilizers. Organic waste enters the surface water in many ways. It may be carried to streams by runoff from industries such as dairy farms and meat packaging. It can also be deposited in the water by sewer overflows and agricultural runoff. Agricultural runoff, mainly fertilizer contains nitrates and phosphates which contribute to a problem called eutrophication. Eutrophication occurs when water contains an excess of organic nutrients. The extra nutrients can cause too many plants to grow, when these plants die bacteria decompose the organic matter and use up valuable oxygen in the process.

When the DO levels of a water body are consistently low, it can have a dramatic affect on the plants and animals living in or near the water body. Often, the result is a drop in the number and diversity of fish and plants in the body of water.

The temperature of the water also has an effect on DO levels. As the temperature rises the solubility, the amount of oxygen that can be dissolved, of the oxygen decreases. Shade, overgrazing, thermal pollution, and other factors can cause dramatic temperature changes.

TURBIDITY
(info from the Adopt-a Stream Foundation)

Introduction:

Excessive amounts of fine sediments can impact aquatic life throughout the stream food chain. When sediment is suspended in the water column, the increased turbidity may prevent sunlight from reaching photosynthesizing algae and other aquatic plants. Turbidity can prevent fish from finding their prey and tends to clog the gills and filter feeding mechanisms of fish and various vertebrates.

Turbidity is the measure of the cloudiness of water. Cloudiness is caused by solids (mainly soil particles) and plankton suspended in the water column. Moderately low levels of turbidity may indicate a healthy, well-functioning ecosystem, with moderate amounts of plankton present to help fuel the food chain. However, higher levels of turbidity pose several problems for stream systems. Turbidity blocks out the light needed by submerged aquatic vegetation. It also can raise surface water temperatures above normal because suspended particles near the surface facilitate the absorption of heat from sunlight.

Suspended soil particles may carry nutrients, pesticides, and other pollutants throughout a stream system, and they can bury eggs and benthic critters when they settle. Turbid waters may also be low in dissolved oxygen. High turbidity may result from sediment bearing runoff, or nutrient inputs that cause plankton or algae blooms.

Turbidity in slow moving, deep waters is easily measured with an inexpensive, often homemade device known as a Secchi disk. A Secchi disk is a 20 cm disk that is lowered into the water until it just disappears and a reading of the depth is taken. A Secchi disk does not work in shallow, fast moving streams. The best instrument for measuring stream turbidity is a nephelometer, an electronic device that measures the amount of light scattered by a sample of water. The lower cost method that we use involves evaluating the fuzziness of a mark at the bottom of a clear tube when a sample of water is poured into the tube. The sample is recorded in Jackson Turbidity Units (JTU's), named after the inventor of the prototype of this method. There is chart provided that lets the tester understand what JTU's mean in a conversion to usable information – in other words, how deep you can see into a stream based on how many JTU's the turbidity reading shows.

TEMPERATURE

Introduction

Temperature (average kinetic energy of molecules) is measured in degrees. The two most commonly used thermometer scales are Celsius and Fahrenheit. Eight major factors can effect the temperature of the water in a stream:

1. The color of the water: if the water or stream bottom is dark, the water will readily absorb light and the temperature will rise. Erosion and other pollutants can have an effect on the water color as well.

2. The depth of the water: deeper water will take longer to heat up.

3. The amount of shade covering the water.

4. The latitude of the waterway: streams in colder climates are naturally colder than those in warm climates.

5. The time of year.

6. The temperature of the water entering the stream.

7. The volume of water.

8. The temperature of any effluents dumped into the water.

Unusually high water temperatures can have a devastating impact on aquatic life and can alter an entire ecosystem. Warm water, for instance, holds less oxygen making it more difficult for aquatic plants and animals to survive. Unnaturally warm water can decrease oxygen levels in several other ways as well, one of which is by increasing the metabolic rate of aquatic plants and microorganisms thereby increasing their oxygen demand.

The life cycles of aquatic insects also tend to speed up in warm water. Animals that feed on these insects can be negatively affected, particularly birds that depend on insects emerging at key times during their migratory flights. Fish migration is also linked to water temperature. In early spring, rising water temperatures may cue fish to migrate to a new location or begin their spawning runs. In the autumn, the drop in temperature spurs baby marine fish and shrimp to move from nursery grounds of the estuaries (where the river enters the ocean) to open water.

Aquatic organisms are adapted to a specific water temperature range. If the temperature of the water increases, cool water species will be replaced by warm water species thus altering the entire ecosystem.

Human activity can have a dramatic affect on water temperature. One problem is thermal pollution caused by dumping relatively warm effluent into lakes and rivers. For instance, nuclear power plants release hot water used to cool machinery. Cutting down trees and shrubs that shade a body of water also causes the temperature to rise because the water is exposed to more sunlight, this can also contribute to soil erosion which raises water temperatures by darkening the water, allowing it to absorb more sunlight. Other problematic occurrences that effect water temperature include over-grazing and urban runoff.

Temperature ranges

32 degrees Fahrenheit or below - Cold blooded animals can not survive

97 degrees Fahrenheit or warmer - Only rough fish like carp and bluegill can survive

72-95 degrees Fahrenheit - between these temperatures most fish reach a temperature in which they can no longer survive

37-77 degrees Fahrenheit - between these temperatures most fish reach a temperature in which they can no longer spawn

Plants also have specific temperatures in which they can grow successfully. The physical stress of rising water temperatures, and the resulting decrease in dissolved oxygen affects aquatic life's sensitivity to toxic wastes, parasites, and disease. Warm water makes substances such as cyanides, phenol, xylene and zinc more toxic for aquatic animals by increasing the chemicals ability to react. If this is combined with low oxygen levels, then the affect is increased.

pH

Introduction

Water (H_2O) naturally dissociates (separates into chemical components) to form H+ (hydrogen ions) and OH- (hydroxyl ions). pH tests measure the concentration of H+. In pure de-ionized water the H+ and OH- concentrations are equal. If the concentration of H+ exceeds the concentration of OH- then the solution is said to be acidic. If the OH- concentration exceeds the H+ concentration the solution is said to be basic. pH is measured on a scale of 0 to 14; pH 7 is neutral, pH values below 7 are acidic and values above 7 are basic.

Animal and human waste and industrial and chemical discharges can have an impact on the pH of water. Another serious problem that affects pH are nitrogen oxides and sulfur dioxides which are released into the atmosphere by automobiles and power plants. While in the atmosphere, they are converted to nitric acid and sulfuric acid, which enter rivers and streams either as acid rain or by acid snow.

The geology of an area can also affect the pH of the water in a watershed. If limestone is present (basic), it helps neutralize acids that might be present in lakes and streams. Acidic water causes metals to be more water soluble (such as bridges or debris in a stream). This can be devastating to fish because dissolved metal particles in the water can accumulate on eir gills and can also cause deformities in younger fish, lowering their chance for survival.

Most organisms are adapted to a particular pH range. If the pH of an environment is altered slightly, it could have a dramatic effect on the survival of resident organisms.

pH ranges

5.0 to 9.0. - Most fish can tolerate pH values in this range.

6.5 to 8.2. - The best water for aquatic life.

3.8 - minimum pH for fish eggs to hatch, but the young are often deformed.

10.0 - maximum pH for fish eggs to hatch, but the young are often deformed.

Taken from: of Cabbages and Chemistry

Great Explorations in Math and Science
Lawrence Hall of Science
University of California at Berkeley

What is pH?

Like the concepts of acid and base, a complete understanding of pH is too difficult for typical 4th–8th graders. If you have mature students and would like to present a simplified version of pH, following is a suggested approach. In *Session 3: Concentrating on Amounts*, in this guide, you present students with the concept of the acid/base continuum. At this time, explain that scientists have come up with a numbering system to quantify how acidic or basic a substance is. The scale runs from 0 to 14. The number in the middle, 7, describes neutrals. Numbers less than 7 are used to quantify acids. The lower the number the "more acidic" the acid. Numbers greater than 7 are used to quantify bases. The higher the number the "more basic" the base.

If possible, follow this explanation with an opportunity to measure the pH of various substances using universal indicator or pH paper.

Here are some pH values of common substances:

human gastric juice	1.3-3.0
lemon juice	2.1
orange juice	3.0
black coffee	5.0
milk	6.9
egg white	7.6-9.5
baking soda in water	8.4
household ammonia	11.9

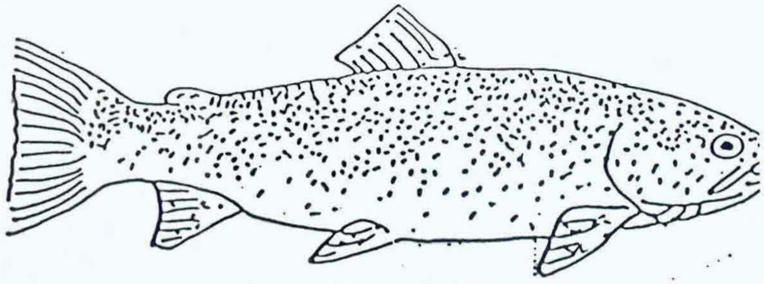
The pH scale is a logarithmic scale, like the Richter scale used to measure the extent of ground movement in earthquakes. This means that a substance of pH 6.0 is ten times more acidic than a substance of pH 7.0, a substance of pH 5.0 is one hundred times more acidic than a substance of pH 7.0, and so on.

The abbreviation pH stands for "the power of hydrogen," and it is a measure of the number of hydrogen ions in a given volume of a substance.

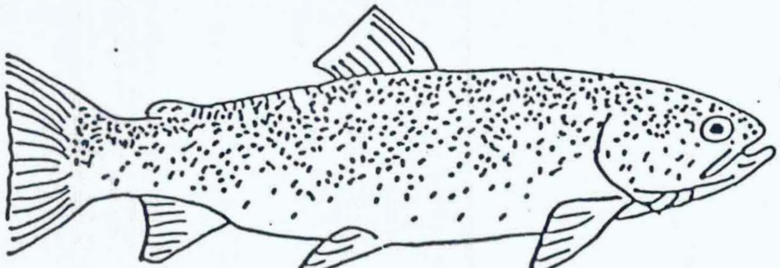
Technically, pH is calculated by determining the negative logarithm of the hydrogen ion concentration expressed in moles per liter of a given substance. The number of hydrog[illegible] in pure water is 10^{-7} moles per liter. B[illegible] calculating the negative logarithm of 10^{-7} one arrives at a pH of 7.0 for water. One of the reasons for this calculation is to make miniscule quantities such as 10^{-7} into more easily usable numbers, like 7.

Please note that because one solution may be 100 times "more acidic" than another, it does not necessarily mean that its effects will also be one hundred times greater. In addition, describing a solution that is "more acidic" as being "stronger" can also be misleading. The question of "concentration" is very important in evaluating the effects and the "strength" of an acid or base. For more discussion of the sometimes confusing terminology used to differentiate "strong" and "weak" acids see the sidebar on page 35 of this guide and the GEMS Acid Rain guide.

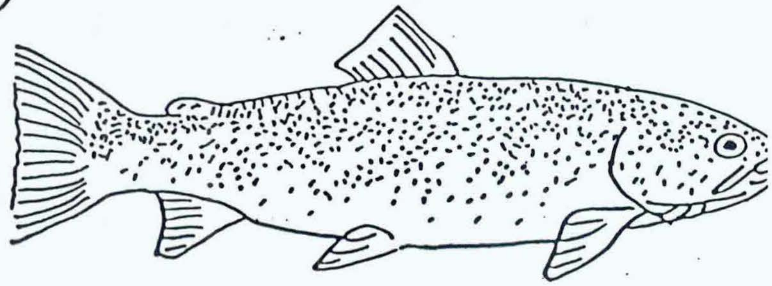
There are two factors that determine the exact shade of pink cabbage juice becomes with a particular acid: 1) the acid's concentration; and 2) the acid's "strength." While an acid's concentration can be changed by adding another substance, such as water, its "strength" is determined by its molecular structure. Acids that easily "dissociate" in water (break into pieces known as ions) are considered to be "strong acids." Those acids that dissociate less readily in water are classified as "weak acids." This is true of most bases as well. These two factors are easily confounded, as you can have a "strong acid" (such as sulfuric or battery acid) made to be extremely dilute, but it would still be referred to as a "strong acid." Similarly, "weak acids" in a concentrated form can be very irritating, but they're still considered to be "weak." Due to the difficulty of explaining these concepts to students w[illegible] have not reached a formal level of reasoning, we have chosen to present only the concept of concentration. If you feel that your students are ready to learn some of these high school level concepts, go ahead and present this information during the session.

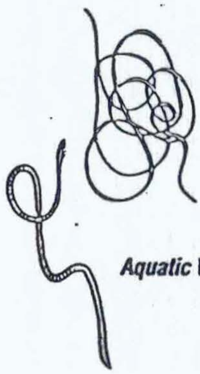


Steelhead



Cutthroat Trout

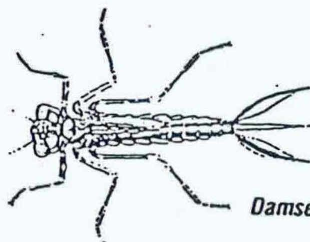




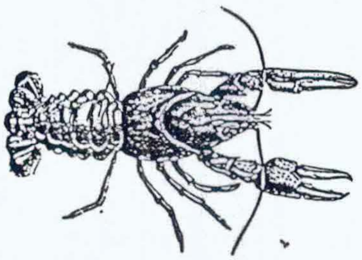
Aquatic Worm:

Midge Fly Larva:

Crane Fly:

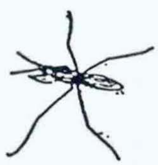


Damselfly:

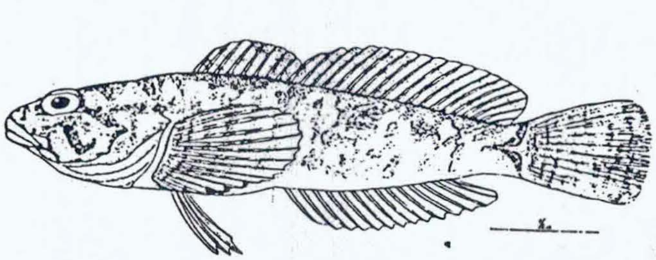


crayfish (or crawdad)

Water strider

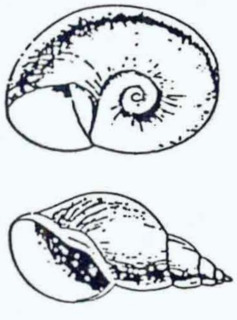


AQUATIC WORMS



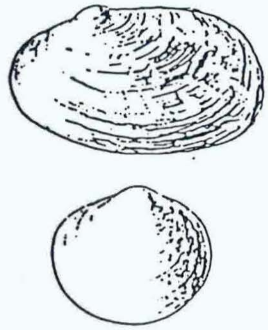
Reticulate sculpin, Cottus perplexus.

SNAILS
Class GASTROPIDA



Single spiral shell

CLAMS AND MUSSELS
Class PELECYPODA



Two-piece hinged shell