

# Additional Useful Information for Exploring Rosario

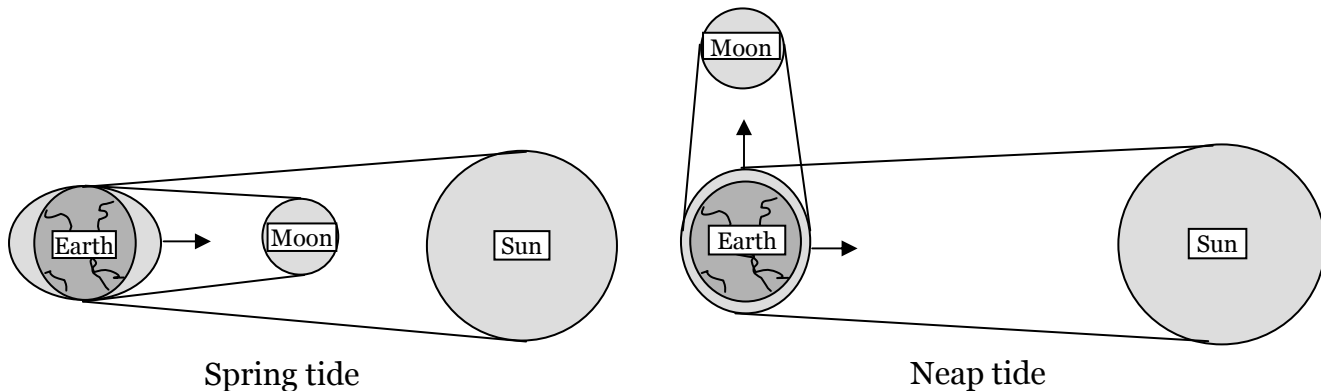
## What makes tides and tide pools?

### Tides...

Two-thirds of the earth's surface is covered by water. This layer of water is in constant motion.

**Tides** are the regular rise and fall (flood and ebb) of the ocean water.

Tides at a given beach are determined by many factors, but the greatest influence comes from the gravitational pull of the moon. The sun's pull also affects the tides. Other factors that affect tides include: winds, barometric pressure, freshwater runoff, storms, and the contours of the surrounding land.



**Spring tides and neap tides...** Tidal ranges are greatest when the sun and moon align, either on the opposite or same side of the Earth, and their pulls combine. This is known as a *spring tide*.

Tidal ranges are least when the sun and moon are at right angles to one another (in relation to the Earth) and their pulls counteract each other. This is a *neap tide*.

**High and low tides** occur each day. In Puget Sound we experience two unequal high tides and low tides daily. Look for the high high tide, the low high tide, the high low tide, and the low low tide.

### Tide pools...

**Tide pools** are created when the tide goes out (ebbs) and leaves pools of saltwater behind in depressions on the land in the *intertidal zone*.

Most mobile creatures move offshore when the tide goes out. Creatures that are unable to move offshore take refuge in tidepools. Many immobile creatures, slow moving creatures, and plants become stranded in these pools of water.

Deeper water species can often be observed in tidepools because saltwater is always present; creatures won't *desiccate*, or dry out, during low tide. Look for greater species diversity in tidepools.

## Intertidal Zones

The *Intertidal zone* is the area of beach that is covered and uncovered by tides.

There are 5 different zones:

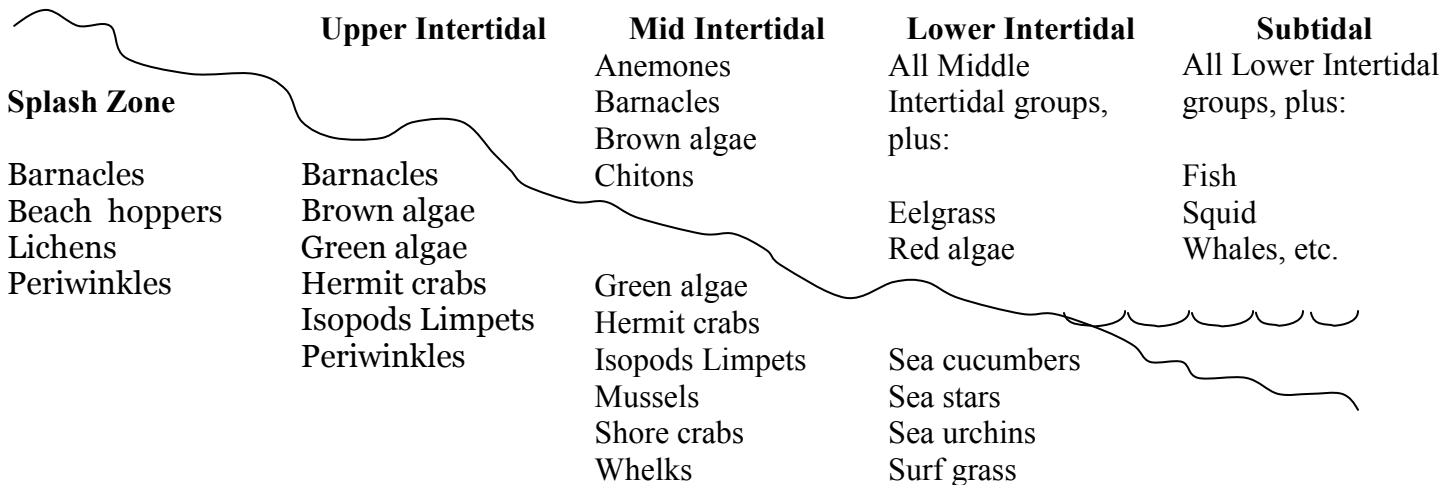
- Splash zone**— area that is sprayed or splashed with water during high tides
- Upper Intertidal zone**— area covered with water only during high tides
- Middle Intertidal zone**— area covered and uncovered twice a day
- Lower Intertidal zone**— area uncovered only during low tides
- Subtidal**— area always covered with water

Plants and animals will live in different zones based on physical conditions, competition with other critters, and predation.

Critters in the Intertidal area have to survive **physical conditions** such as long exposure to the air, summer heat, winter cold, salinity changes (from rain or rivers), UV exposure, and desiccation (drying out). Those creatures that live high in the Intertidal zone have adapted better to survive these conditions.

As you move deeper in the Intertidal area, look for differences in the types of critters encountered... Critters are larger and taller, there is greater species diversity, larger algae species dominate, and red algae is more prevalent

When visiting the beach, try to identify which tidal zone you are in based upon the critters (or groups of critters) that are present:



***Intertidal creatures have not adapted to impacts caused by humans, so please remember to follow the beach etiquette rules.***

# Tide Pool Creatures

## Things you will probably see: (depending on the tidal height)



**Green, Brown, and Red Algae** (a.k.a. seaweeds) are marine plants that are classified by their photosynthetic pigments (and in general, their color). Brown algae are commonly known as kelp. Seaweeds obtain carbon dioxide and nutrients directly from the water. They consist of a blade (leaf), a stipe (stem), and a root-like holdfast. The holdfast is used to anchor the plant to the seafloor. Many species also have a float or bulb allowing the seaweed to reach sunlight.

**Barnacle** is best described as a shrimp standing on its head. This crustacean begins its adult life when the larva attaches to a rock or other surface. By adulthood, barnacles grow a hard shell consisting of six outer plates and four inner plates which close when exposed to air. Barnacles feed by sweeping the water with purple plume-like feet and collecting *detritus* (dead organic material) and plankton.



**Shore Crabs** are crustaceans with exoskeletons. When the crab grows too big for its shell, it sheds the old shell (molts) and grows a new one. Look for crab shells... are the crabs dead or is it a molt? Give it a whiff; decaying meat stinks, molts don't.

**Hermit Crabs** are crustaceans with special soft bodies that allow them to fit into the shells of snails...as they grow, they find new, larger shells. They feed mainly on detritus and algae.



**Periwinkles/Snails** are small gastropods that are found high in the Intertidal. They feed on algae using a scraping radula (which works like sandpaper). They are often found near cracks in the rocks where moisture collects and algae grows.

**Whelks/Snails** are larger than periwinkles, and they feed on mussels and barnacles. They are predators. They use their radula to drill a hole through the shell, inserting digestive juices, then sucking out the soft-bodied animal.



**Limpets** are mollusks whose shell resembles a hat or mountain. Limpets can be found clinging tightly to rocks. When covered by water, they will venture out to feed on algae and diatoms, and then often return to the same spot.

**Mussels** are mollusks with two hinged shells and are attached to rocks by byssal threads. Siphons draw in water containing plankton to be filtered for food. The blue mussel is seen at Rosario, but despite the name can be blue, black, or brown in color.



**Anemones** look like soft olives with pink centers at low tide, and flowers when they are covered by water. They feed using sticky tentacles to catch and paralyze small crustaceans (like crabs) and other animals. Their green body color comes from green algae

**Sculpins** are tide pool fish. They feed on tiny crustaceans and bits of larger critters that fall into the tide pool. They survive in tide pools because they can tolerate great swings in temperature, oxygen, and salinity.



## More Tide Pool Creatures

### Things you may see:



**Chitons** are marine animals. These mollusks use a scraping radula (similar to snails) to graze on bacteria and algae clinging on rocks. They have a muscular foot covered by eight plates (look for these butterfly shaped shells on the beach) and surrounded by a girdle. They suction themselves to rocks during low tide and glide along rocks when covered by water at night.

**Sea Cucumbers** are *echinoderms*, related to sea stars, sea urchins, and sand dollars. They have a long, soft or leathery body. They feed on detritus using their feathery tentacles. Look for the bright orange or dark maroon color of the orange cucumber at Rosario.



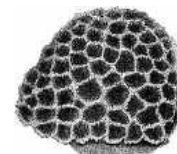
**Sea Stars** are also echinoderms with five or more rays. They move using their tube feet. Most prey upon mussels, barnacles, and clams, but some are filter-feeders.

**Sea Slugs** are shell-less gastropods. They breathe through the surface of their body. Many are *omnivores*, eating both meat and plants.



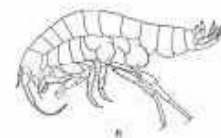
**Red Rock Crabs** are larger, up to 6" across the back (carapace). They have black-tipped claws and a hard carapace. Look for them hiding under seaweed.

**Sponges** are primitive, multi-celled organisms. They are filter-feeders, pulling plankton from water that is cycled through pores and holes. They attach to rocks, wood, and shell. Encrusting sponges are most common at Rosario.



**Isopods** are a marine version of the pill bug. They have seven sets of legs and wide, flattened bodies. Many feed on dead algae.

**Amphipods** are insect-like critters with a body flattened side-to-side; they often look like miniature shrimp. They typically feed on seaweed and detritus. Look for them near dead seaweed in the water and on land.



### Things you rarely see:



**Orcas** are the largest dolphins. Resident Orcas travel in larger pods (~20 animals) and eat mostly fish and squid. Transient Orcas travel in smaller groups and hunt marine mammals. Look for the white saddle patch (behind the tall dorsal fin) on a black back.

**Sea Urchins** are echinoderms with a sphere-shaped shell covered with mobile spines and tube feet. The mouth is found in the center of the lower side, and the anus is in the center of the upper side. They eat detritus and seaweed.



**Ascidians** are filter feeders, passing water through its body. Many animals will form colonies in a stiff, jelly-like matrix. These are colonial ascidians, while larger solitary ascidians are called sea squirts.

**Gunnels** are eel-like fish with a tail fin and long dorsal fin. They are omnivores, feeding on isopods, amphipods, and detritus.



# Rosario Beach Species List

Updated Feb 2007 – Compiled by WSU Extension Beach Watchers monitoring program since 1995

## Animals

### Porifera (Sponge)

*Cliona celata* (boring sponge)  
*Halichondria* sp. (breadcrumb sponge)  
*Haliclona* sp. (purple encrusting sponge)  
*Ophlitaspongia pennata* (red encrusting sponge)

### Cnidarians (Anemones, jellyfish, hydroids, corals)

*Anthopleura elegantissima* (aggregating anemone)  
*Anthopleura xanthogrammica* (giant green anemone)  
*Epiactis* sp. (brooding anemone)  
*Haliplanella lineata* (striped anemone)  
*Metridium* sp. (white plumed anemone)  
Stalked jelly  
*Urticina crassicornis* (Christmas or painted anemone)  
*Urticina lofotensis* (white spotted anemone)

### Worms

#### Flatworms

*Freemanina litoricola*  
*Notoplana sanguinea*

#### Nemertean (ribbon worms)

*Amphiporus* sp. white ribbon worm  
*Cerebratulus* sp.  
*Emplectonema gracile* green ribbon worm  
*Paranemertes peregrine*-purple ribbon worm  
*Tubulanus polymorphus* (red ribbon worm)  
*Tubulanus sexlineatus* (six-lined ribbon worm)  
(seen on Bowman Bay side)

#### Polychaetes (segmented marine worms)

*Arctonoe* sp. commensal scaleworm  
*Dodecaceria* sp. fringed tube worm  
*Eudistylia vancouveri* feather duster worm  
*Nereis* sp. (pile worm)  
*Ophiodromus pugettensis* (seen on Bowman Bay side)  
*Serpula* sp. (calcareous tube worm)  
*Spirorbis* (tiny coiled tubeworm)

### Mollusks

#### Limpets

*Acmea mitra* (whitecap limpet)

*Diodora aspera* (keyhole limpet) (not a “true” limpet)

*Lottia digitalis* (finger limpet)  
*Lottia paradigitalis*  
*Lottia pelta* (shield limpet)  
*Tectura persona* (masked limpet)  
*Tectura scutum* (plate limpet)

#### Chitons

*Cryptochiton stelleri* (gumboot chiton)  
*Katharina tunicata* (black katy or leather chiton)  
*Mopalia ciliata* (hairy chiton)  
*Mopalia lignose* (woody chiton)  
*Mopalia muscosa* (mossy chiton)  
*Tonicella lineata* (lined chiton)

#### Snails

*Calliostoma ligatum* (topsnail)  
*Ceratostoma foliatum* (leafy hornmouth)  
*Fusitriton oregonensis* (Oregon triton)  
*Lirabuccinum dira* (dire or spindle whelk)  
*Littorina scutulata* (checkered periwinkle)  
*Littorina sitkana* (Sitka periwinkle)  
*Marsenina stearnsi* (Stearn’s ear shell)  
*Nucella canaliculata* (channeled dogwinkle)  
*Nucella ostrina* (emarginate dogwinkle)  
*Nucella lamellosa* (frilled dogwinkle)

#### Sea slugs

*Acanthodoris hudsoni* Hudson’s dorid  
*Acanthodoris nanaimoensis* Nanaimo dorid  
*Aeolidia papillosa* (shaggy mouse nudibranch)  
*Archidoria montereyensis* (sea lemon)  
*Dialulu sandiegensis* (leopard or spotted nudibranch)  
*Dirona albolineata* (chalk lined or alabaster nudibranch)  
*Dirona pellucida* (golden dirona)  
*Hermisenda crassicornis* (opalescent nudibranch)  
*Onchidella borealis* (Leather limpet)  
*Onchidoris bilamellata* (barnacle eating nudibranch)  
*Rostanga pulchra* (red nudibranch)  
*Triopha catalinae* (clown nudibranch)

#### Bivalves

*Chlamys hastata* (Pacific pink scallop)  
*Chlamys rubida* (smooth pink scallop)  
*Crassadoma gigantea* (giant rock scallop)

*Crassostrea gigas* (Japanese oyster)  
*Mytilus californianus* (California mussel)  
*Mytilus trossulus* (blue or bay mussel)  
*Pododesmus cepio* (false jingle shell)

### Cephalopods

*Enteroctopus dofleini* (giant Pacific octopus)  
*Loligo opalescens* (opalescent squid)

### Crustaceans

#### Amphipods

*Traskorchestia traskiana* (beach hopper)

#### Isopods

*Gnrimosphaeroma oregonense* (pillbug)  
*Idotea wosnesenskii* (rockweed isopod)  
*Ligia pallasii* (sea slater)

#### Barnacles

*Balanus crenatus* (smooth white barnacle)  
*Balanus glandula* (acorn barnacle)  
*Balanus nubilus* (giant barnacle)  
*Chthamalus dalli* (little brown barnacle)  
*Semibalanus cariosus* (thatched barnacle)

#### Crabs

*Cancer magister* (Dungeness crab)  
*Cancer oregonensis* (pygmy rock crab)  
*Cancer productus* (red rock crab)  
*Cryptolithodes sitchensis* (turtle or umbrella crab)  
*Hemigrapsus nudus* (purple shore crab)  
*Hemigrapsus oregonensis* (hairy or Oregon shore crab)  
*Lophopanopeus bellus* (black clawed crab)  
*Oregonia gracilis* (decorator crab)  
*Pagurus granosimanus* (granular hermit crab)  
*Pagurus hirsutiusculus* (hairy hermit crab)  
*Petrolisthes* sp. (porcelain crab)  
*Pugettia gracilis* (graceful kelp crab)  
*Pugettia producta* (kelp crab)  
*Scyra acutifrons* (sharp-nosed crab)

#### Shrimp

*Heptacarpus* sp.  
*Pandalus danae*

### Arachnids

*Neomolgus littoralis* (red velvet mite)

### Bryozoans

*Membranipora* (encrusting bryozoan)  
*Heteropora* sp. (northern staghorn bryozoan)

### Brachipods

*Terebratalia transversa* (lamp shell)

### Echinoderms

#### Sea stars

*Evasterias traoschellii* (mottled sea star)  
*Henricia leviuscula* (blood star)  
*Leptasterias hexactis* (six-rayed or brooding star)  
*Pteraster tesselatus* (cushion star)  
*Pycnapodia helianthoides* (sunflower star)  
*Solaster stimsoni* (striped sun star)

#### Brittle star

*Ophiopholis aculeate* (daisy brittle star)

#### Sea cucumbers

*Cucumaria miniata* (red sea cucumber)  
*Eupentacta quinquesemita* (white sea cucumber)  
*Psolus chitonoides* (armored sea cucumber)  
*Parastichopus californicus* (giant sea cucumber)

#### Sea urchins

*Strongylocentrotus droebachiensis* (green sea urchin)  
*Strongylocentrotus franciscanus* (red sea urchin)  
*Strongylocentrotus purpuratus* (purple sea urchin)

### Tunicates

*Cnemidocarpa finmarkiensis* (shiny orange sea squirt)  
*Boltenia villosa* (hairy tunicate)  
*Chelyosoma productum* (solitary or horseshoe tunicate)  
*Didemnum/Tridemnum* complex (white glove leather ascidian)  
*Pyura hauster* (wrinkled sea squirt)

### Tidepool fish

*Ascelichthys rhodorus* (rosylip sculpin)  
*Clinocottus globiceps* (mosshead sculpin)  
*Gobiesox maeandricus* (flathead clingfish)  
Gunnels  
*Oligocottus maculosus* (tidepool sculpin)  
*Oligocottus rimensis* (saddleback sculpin)  
*Oligocottus snyderi* (fluffy sculpin)

### Seaweeds

#### Green

*Acrosiphonia coalita* (green rope)  
*Cladophora* sp. (green tuft)  
*Codium fragile* (dead man's fingers)

*Enteromorpha* sp. (green ribbon)  
*Prasiola meridionalis* (emerald carpet)  
*Ulva* sp. (sea lettuce)  
*Urospora penicilliformis* (green hair)

### **Brown**

*Agarum fimbriatum* (fringed sieve kelp)  
*Alaria marginata* (winged kelp)  
*Analipus japonica* (bottlebrush seaweed)  
*Colpomenia peregrina* (bulb seaweed)  
*Costaria costata* (seersucker)  
*Cymathere triplicate* (three-ribbed kelp)  
*Desmarestia aculeate* (witch's hair)  
*Desmarestia viridis* (stringy acid kelp)  
*Egregia menziesii* (feather boa kelp)  
*Fucus gardneri* (rockweed)  
*Hedophyllum sessile* (sea cabbage)  
*Laminaria bongardiana* (split kelp)  
*Laminaria saccharina* (sugar kelp)  
*Leathesia difformis* (sea cauliflower)  
*Nereocystis luetkeana* (bull kelp)  
*Pterygophora californica* (woody stemmed kelp)  
*Ralfsia* (sea fungus tarspot)  
*Sargassum muicum* (wireweed)  
*Scytosiphon lomentaria* (soda straws)

### **Red**

*Antithamnion* sp.  
*Ceramium* sp. (staghorn felt)

Coralline algae upright and encrusting  
*Endocladia muricata* (sea moss)  
*Chondracanthus exasperate* (Turkish towel)  
*Halosaccion glandiforme* (sea sacs)  
*Hildenbrandia* (red tar spot; rusty rock)  
*Hymenena* sp. (veined blade)  
*Mastocarpus papillata*-upright and *Petrocelis* forms  
(Turkish washcloth and black tar spot)  
*Mazzaella splendens* (iridescent seaweed)  
*Microcladia borealis* (coarse sea lace)  
*Microcladia coulteri* (delicate sea lace)  
*Neorhodomela larix* (black pine)  
*Odonthalia floccosa* (sea brush)  
*Odonthalia washingtoniensis* (flat sea brush)  
*Plocamium cartilagineum* (sea comb)  
*Polysiphonia* spp.  
*Porphyra* (brown cellophane)  
*Sarcodiotheca gaudichaudii* (succulent seaweed)  
*Smithora naiadum* (red fringe)  
*Soranthera ulvoidea* (studded sea balloons)

### **Seagrass**

*Phyllospadix scouleri* (surfgrass)

### **Backshore plants**

*Lathyrus japonicus* (beach pea)  
*Leymus mollis* (native dunegrass)  
*Plantago maritima juncooides* (seaside plantain)

## **Bibliography of Books on Intertidal Plants and Animals**

### **Excellent general references:**

- Harbo, R.M. 1997. *Shells and Shellfish of the Pacific Northwest: A Field Guide*. Madeira Park, B.C.: Harbour Publishing.
- Harbo, R.M. 1999. *Whelks to Whales: Coastal Marine Life of the Pacific Northwest*. Madeira Park, B.C.: Harbour Publishing.
- Kozloff, E.N. 1993. *Seashore Life of the Northern Pacific Coast*. Seattle: University of Washington Press. (Excellent source. If you can buy only one book, this is a good choice.)
- Sept, J.D. 1999. *The Beachcombers Guide to Seashore Life in the Pacific Northwest*. Madeira Park, B.C.: Harbour Publishing.
- Sheldon, I. 1998. *Seashore of the Pacific Northwest*. Renton, WA: Lone Pine Publishing.
- Yates, S. 1988. *Marine Wildlife of Puget Sound, the San Juans, and the Strait of Georgia*. Chester, CT: Globe Pequot Press.

### **References for specific groups of creatures or algae:**

- Behrens, D.W. 1991. *Pacific Coast Nudibranchs: A Guide to the Opisthobranchs: Alaska to Baja California*. Monterey, CA: Sea Challengers.
- Gotschall, D.W. 1991. *Guide to Marine Invertebrates: Alaska to Baja California*. Monterey, CA: Sea Challengers.
- Gotschall, D.W. 1989. *Pacific Coast Inshore Fishes*. Monterey, CA: Sea Challengers.
- Gotschall, D.W. and L.L. Laurent. 1979. *Pacific Coast Subtidal Marine Invertebrates*. Los Osos, CA: Sea Challengers.
- Jensen, G.C. 1995. *Pacific Coast Crabs and Shrimps*. Monterey, CA: Sea Challengers.
- Lambert, P. 1997. *Sea Cucumbers of British Columbia, Southeast Alaska, and Puget Sound: Royal British Columbia Museum Handbook*. Vancouver, B.C.: UBC Press.
- O'Clair, R. and Lindstrom. 2000. *North Pacific Seaweeds*. Friday Harbor, WA: Plant Press.
- Smith, D.L. 1977. *A Guide to Marine Coastal Plankton and Marine Invertebrate Larvae*. Dubuque, IA: Kendall / Hunt Publishing Company.
- Wrobel, D. and C. Mills. 1998. *Pacific Coast Pelagic Invertebrates: A Guide to the Common Gelatinous Animals*. Monterey, CA: Sea Challengers.

**For the truly serious:**

Gabrielson, P.W., R.F. Scagel, and T.B. Widdowson. 1990. *Keys to the Benthic Marine Algae and Seagrasses of British Columbia, Southwest Alaska, Washington, and Oregon*. Phycological Contribution No. 4. Vancouver, B.C.: University of British Columbia.

Kozloff, E.N. 1990. *Invertebrates*. San Francisco: Saunders College Publishing.  
(Excellent college-level text book.)

Kozloff, E.N. 1996. *Marine Invertebrates of the Pacific Northwest*. Seattle: University of Washington Press. (A valuable set of keys, plus helpful illustrations.)

**Shore plant identification:**

Pojar, J. and MacKinnon. 1994. *Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia, and Alaska*. Ministry of Forests and Lone Pine Publishing.

There are many more potentially useful and enjoyable books. Look for great finds in secondhand book stores.