

Adaptations of animals to cold environments



- *Very few species due to lack of ecological niches
- *Large numbers of single species such as lemmings and caribou
- *Population numbers may be cyclical
- *Some species are unique to the tundra environment others migrate
- *Marine life is surprisingly rich, biodiversity is high fed by planktonic blooms



- *Very cold climate means low numbers of species and low densities
- *Low temperatures means thick high quality fur for insulation, increased metabolic rates or hibernation through the cold winter
- *Small animals may live below the snow patches or have white fur to aid camouflage like the Arctic Fox
- *Summers are short so the breeding cycle is compressed and animals have large clutches/litters. Food chains are simple and short



Threats to the Alaskan Tundra environment



Oil has been exploited from the north slope of Alaska at Prudhoe Bay since 1977. This involved building an oil pipeline (TAPS) Trans Alaskan Pipeline to move oil from the ice bound north to the ice free port of Valdez in Southern Alaska

Some environmentalists say that this development has had a negative impact on the tundra environment and its flora and fauna as well as the traditional lives of the Inuit (Inupiak) Indians due to the developments and the oil spills, notably by the Exxon Valdez in Prince William Sound in 1989

Negative impacts :- Oil spills kill many species and seriously damages ecosystems. The oil remains for many years and the whole food chain particularly in coastal marine areas may be affected

Pipelines also have a negative impact on the environment, melting the permafrost, a key element of the tundra environment, and affecting migrations

Breeding grounds of some species are affected, habitats are lost and the fragile ecosystem is destroyed

Oil companies now want to drill in the ANWR (Arctic National Wildlife Refuge), a protected area with 45 species of mammals including the pygmy shrew, caribou, moose and bears, and 180 bird species including snow geese and peregrine falcons

Impacts of oil exploration and exploitation

EXXON VALDEZ OIL SPILL DISASTER

On March 24, 1989, the ship hit Bligh Reef near Alaska, opening a large hole on its hull. The ship was full of oil at the time, carrying a total of 1.2 million barrels (190 million litres).

Quickly, huge amounts of oil spilled into the ocean.

Once out of the ship, the oil spread quickly. It ended up creating a 1,776 square mile (4,600 square kilometre) spill and gave 3,167 miles (5,100 kilometres) of coastline an oily covering.

The damage from the spill was tremendous. Between 100,000 and 600,000 birds, 5,500 sea otters, 30 seals, and 22 whales were killed. Many other animals likely died as well and were never found. Other animals, such as bald eagles, that ate the oil-poisoned fish from the spill area were also killed.

Though public outrage eventually mounted, the reaction to the oil spill came slowly. The Alaska Oil Spill Team was slow to respond, and by the time that work on cleaning up the area began, massive amounts of oil had already spread to a large area surrounding the ship.

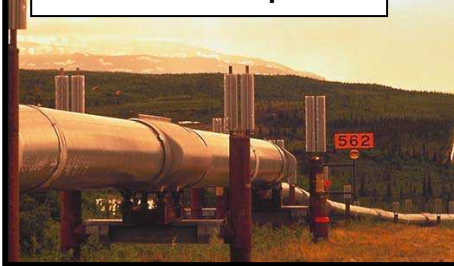
The Exxon Corporation was forced to clean up the spill and fined heavily for the damage it had caused. The company spent \$2.2 billion for cleanup work, and the total costs will likely amount to over \$4 billion.

Eleven million gallons of crude oil leaked into one of the most bountiful marine ecosystems on the planet, killing 1000 to 2800 sea otters, as many as 250,000 seabirds, over 300 harbor seals, and at least 22 orca whales.

Within a week, currents and winds pushed the slick 90 miles from the site of the mishap, out of Prince William Sound and into the Gulf of Alaska. It eventually oozed nearly 600 miles away from the wreck, contaminating 1,500 miles of shoreline.



Trans Alaskan Pipeline



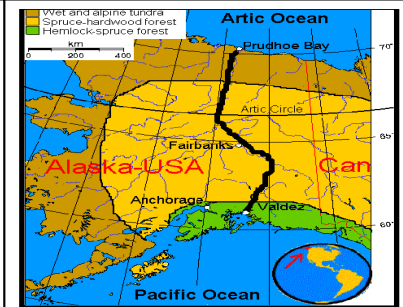
A MATTER OF FACT

Why is some of the pipeline above ground?



420 miles of the 800-mile trans-Alaska pipeline is elevated above ground to protect the delicate permafrost. Permafrost is permanently frozen soil and covers approximately 75% of the pipeline corridor. Vertical supports elevate the pipe 5 to 15 feet above the ground to prevent heat of the pipeline from melting the permafrost. The other 380 miles of pipe are buried in ground that remains stable even if it thaws and refreezes.

Alyeska pipeline



Permafrost and Vegetation

- The oil which runs through the pipes is at 82°C. This would melt the permafrost which would destroy the delicate environment. Melting permafrost causes subsidence which would cause the pipeline to sink and break.
- 420 miles of the pipeline are above the ground.
- 4 miles are refrigerated below ground.
- For 376 miles of thaw-stable and non-permafrost areas, the pipe is laid below ground.
- Vegetation in the Tundra can take 20 years to grow again once disturbed due to the short growing season and harsh conditions. Quick growing species were introduced once construction finished to stabilise the area.
- The pipe line has been designed with radiators to allow heat to escape into the air rather than the ground.

Case Study: Trans-Alaska Pipeline System

- Designed and constructed to move oil from the North Slope of Alaska to the most northerly ice free port – Valdez.
- Length – 800 miles (1300km).
- Diameter – 48 inches.
- Crosses three mountain ranges and 834 rivers and streams.
- Oil was discovered in 1968 – 7 years of planning.
- Cost \$8 billion to build in 1977.
- More than 70,000 people worked at some point on the project (31 people died).
- The first oil moved through the pipeline on June, 20th 1977.
- Delivers 20% of US domestic oil production.

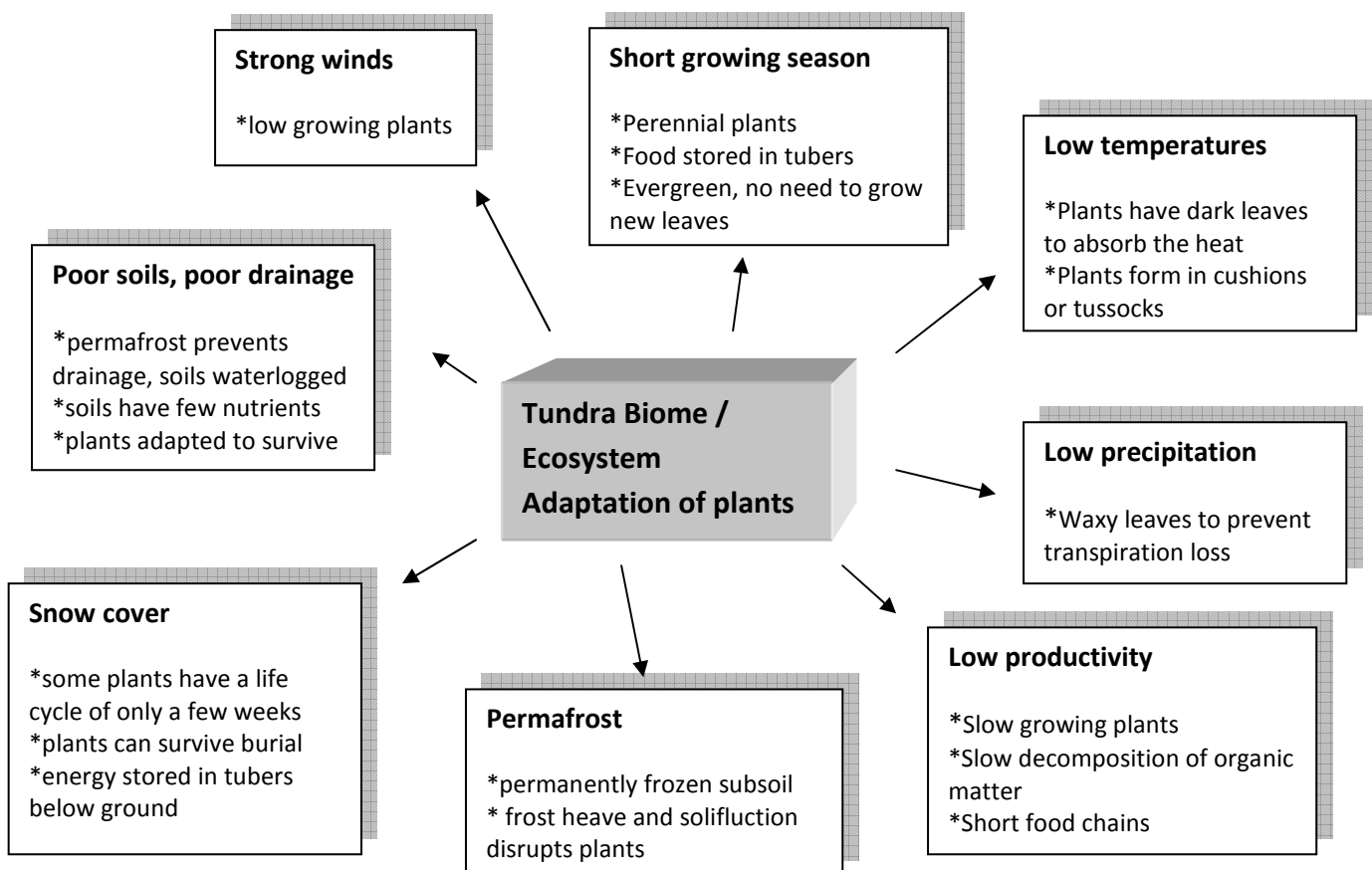
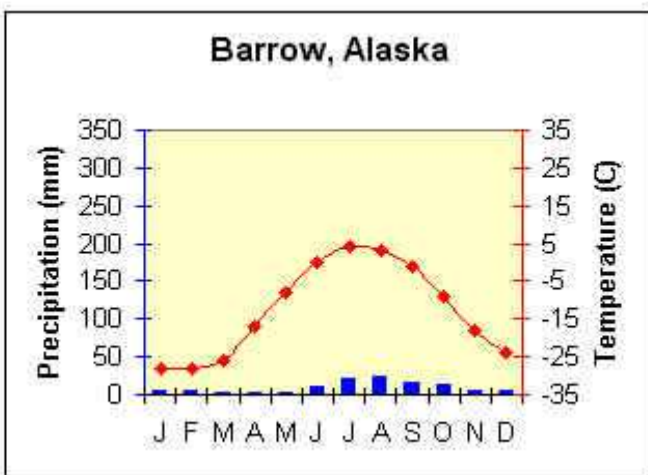
Valdez

- Most northerly ice free port.
- Deep anchorage.
- Delicate ecosystem where an oil spill would be disastrous.
- Alyeska, who own the pipeline, spends \$60 million each year on oil spill prevention and response.
- All tankers are escorted by special vessels when in Prince William Sound to help navigate the difficult waters and avoid possible ice-bergs.

A Fragile Ecosystem

The Tundra climate

- The north of Alaska is between 60 – 70 degrees north and has a Tundra climate where winter temperature drop to below -20 degrees Celsius. Summers are mild with temperature reaching +5 to +10 degrees giving a very large annual temperature range
- In many areas the subsoil is permanently frozen, Permafrost, although the surface 'active layer' may thaw out in summer and be subject to landslips and solifluction
- Frost shattering is an important weathering process on exposed rocks particularly in the mountainous areas
- Precipitation totals are low, often under 200mm due to the low temperatures, and distance from the ocean (the Arctic Ocean is ice bound for most of the year). In winter snow cover is complete and can be heavy



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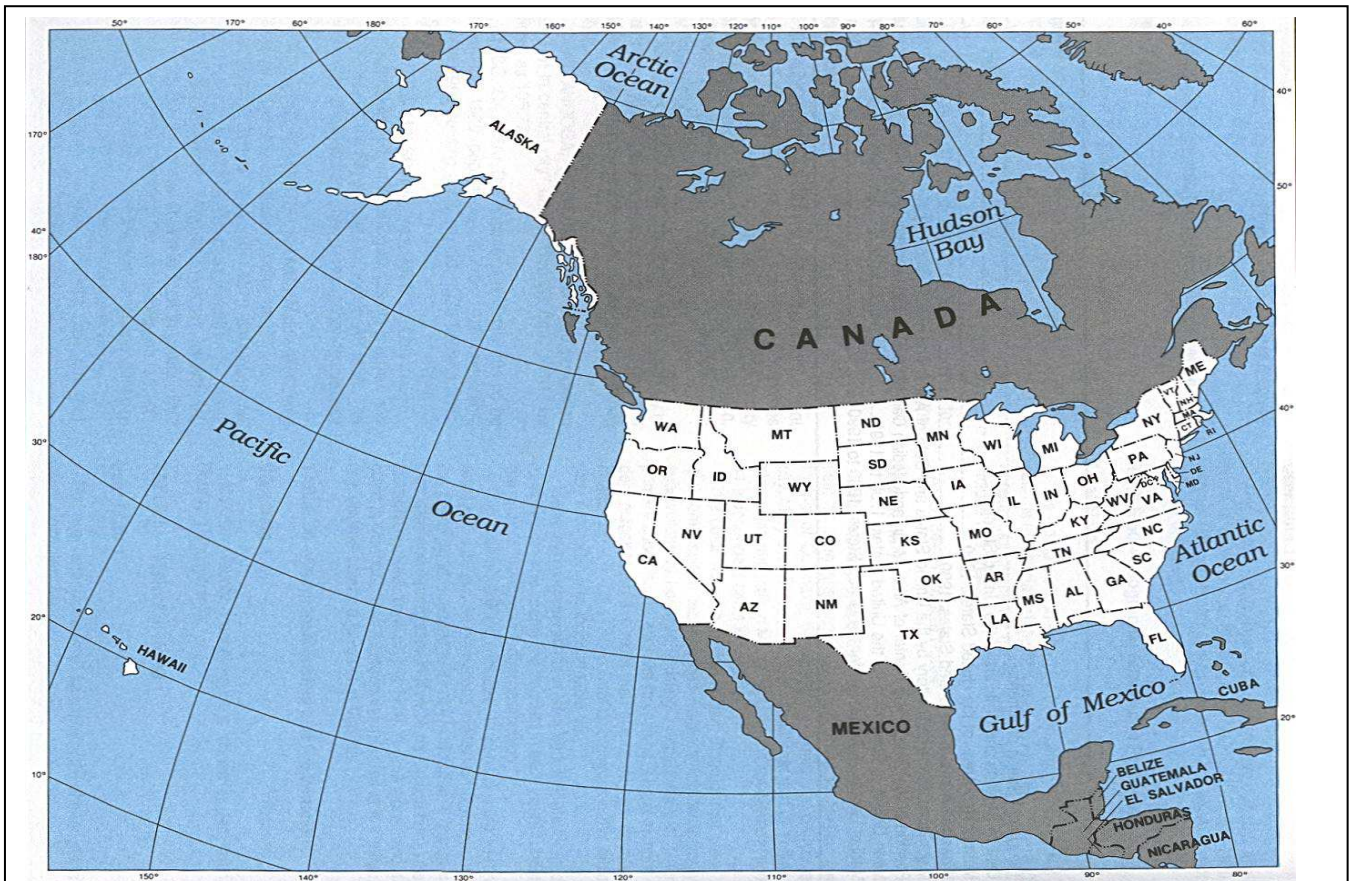
GEOGRAPHY

CASE STUDY REVISION BOOKLET

ALASKA

USA

A COLD ENVIRONMENT (WILDERNESS) UNDER THREAT



FACTFILE :-

- Alaska is the largest state in the USA by area, but has a population of less than 750,000
- Much of Alaska is north of the Arctic Circle and has a Tundra or Periglacial climate
- Precipitation is low, but winter temperatures are well below freezing
- Both plants and animals have adapted to the extreme environment
- The Capital is Juneau, but the largest city is Anchorage