Physical geography 2: Climate, soils, vegetation
Physiographic Regions

- You can divide Canada into physiographic regions
  - Zones with common characteristics of climate, soil, topography
  - Terminology has changed, thanks to NAFTA

- National Atlas
Figure 2.1  Physiographic regions and continental shelves in Canada.

The Arctic Lands consist of a dozen large islands and numerous small islands that together are known as the Arctic Archipelago. The Canadian Shield is the largest physiographic region and extends beneath the Interior Plains, the Hudson Bay Lowland, and the Great Lakes–St Lawrence Lowlands. (Further resources: Atlas of Canada, 1967, ‘Physiographic Regions,’ at: <atlas.nrcan.gc.ca/site/english/maps/environment/land/arm_physio_reg>.)
Canada’s Physical Regions

- Cordillera (the western mountains)
- Interior plains (prairies)
- Canadian Shield
- Great Lakes-St Lawrence Lowlands (you are here)
- Appalachian Uplands
- Hudson Bay lowlands
- Arctic Archipelago
- Plus 3 ocean shelves
Climate

• Climate affects soil, vegetation
  – Therefore shapes agriculture
• Canada’s climate reflects global and more local conditions
Global Influences on Canada’s Climate

- Canada occupies a lot of northern latitude
  - Alert NU 82° N the world’s most northerly settlement
  - Middle Island ON 41 °N is southernmost point in Canada
    - The tip of Point Pelee
- 41 degrees of latitude
  - Climates range from warm to cold
Global Influences on Canada’s Climate

• Canada’s climate gets heat in three major ways
  – Direct sunlight (the effect fades northwards, and at night)
  – Flows of warm air
  – Ocean currents
    • Moves the most heat, worldwide.
Global Influences on Canada’s Climate

- Cold, rather dry, polar air flows south toward the equator
- Warm, moist air flows towards the poles
- The Earth’s rotation deflects the movements diagonally
- Where these meet, there will be instability
  - Hot air rises over cold, drops moisture
Global Influences on Canada’s Climate

- Canada occupies the latitudes where polar and tropical air mix
- The mixing zone creates
  - high-altitude winds: The Jet Stream
  - Frontal systems, storms which track along the jet stream
The Polar Jet
The Jet Stream

• Very fast (322 kmh) high altitude wind (11 km up)
• Blows E to W around much of the world
• Polar jet forms where warm subtropical air meets cold polar air
  – Frequently there is also a weak subtropical jet
Seasonal Variations

- In summer the polar/tropical convergence zone moves north
  - Much of Canada gets a warm summer
- In winter the polar/tropical convergence zone moves south
  - Much of Canada gets a cold winter
- Canadian climate is very seasonal
Toronto and the Polar Jet

• City is north of polar jet in winter
  – Brings in cool, dry arctic & subarctic air
  – N and NW winds, lake effect snow

• City is south of polar jet in summer
  – Brings in warm moist tropical air
  – S, SE, SW winds
More Local Influences

• Canada is big northern part of a big continent
  – Continental edges have milder climates, modified by the ocean
  – Continental interiors have harshly contrasting climates
  – Canada has a lot of continental interior
January in Two Cities

- London UK
- Edmonton AB
Jan 24 2007
Jan 2005 London
A Question

• London UK and Edmonton have approx.
  – Similar latitudes (51 °N)
  – Similar summer temperatures (July mean is 22-23 °C)
• But Edmonton has much colder winters
  – Edmonton mean January temp: -7.3 °C
  – London mean January temp: 7.2 °C
• Why?
Answer:

• NW Europe is warmed by an ocean current
  – Makes London mild, rainy
• Winter in the Canadian interior is not modified by ocean currents
  – Edmonton freezes in winter
• Ocean currents modify Canadian maritime climates
  – Halifax, Vancouver, Newfoundland
Mountain Effects

- Mountains of the Cordillera, plus cool ocean currents
  - provoke massive rainfall from moist Pacific air
  - shield western interior from Pacific moisture
  - provoke Chinook winds
The Chinook

• Associated with a classic cloud formation
  – The chinook arch
Permafrost

- Extensive northern zone with cold climate
- Ground permanently frozen
  - On dry land, lake beds, sea floor
- Top surface may melt in summer, refreeze in winter
- Depth and continuity varies: up to 1000 m deep.
- Long-duration
Permafrost is 400 m thick here
• Tuktayuktuk NWT has excavated a community cold storage area out of the permafrost
• -20 at 5 metres in August
• Used to preserve game carcasses
Brochet MB

- Discontinuous permafrost 1.5 m thick
Nain NL

- Continuous permafrost
- Ice is less than 10% of the soil
Building on Permafrost

• Gives a solid footing, if you can keep it frozen
• Either drill through to bedrock
• Or insulate the permafrost from building heat
  – Ventilation, insulation
  – Run utilities in insulated utility corridors (utilidors)
Churchill Falls NL

- Sporadic permafrost, up to 90 cm thick
- Ice is 1% of the soil
Inuvik NWT

- Water supply, sewage handled by utilidors
  - Insulate the sewage and water from winter cold,
  - Insulate the ground from the heat of water and sewage
Inuvik NWT

• A city of tubes
Pingos

- Frost-heave hills created out of frozen lake beds
- A feature of the permafrost
- Very common in the Mackenzie lowlands
Tuktoyuktuk NWT
Permafrost

• Regulates vegetation growth, especially for trees
• Trees need water and hence a deep seasonally-thawing active zone
  – Easier on southerly-facing slopes, in river valleys
• Tree cover fades away on northerly slopes, and away from rivers
Climate change

- Is melting the permafrost
Previously frozen slopes collapse:
Paulatuk NWT
Climate of Western Interior

- Prairies+
- No east-west mountain barriers
- Open to air masses from arctic and tropics
- Dry climate, with huge seasonal temperature contrasts
Climate in Atlantic Canada

- Warm North Atlantic Drift meets Cold Labrador current
- Moist, cool, stormy climate, with fog
  - Most storms track up the eastern seaboard
Climate of Toronto

- Modified by Lake Ontario
  - Retards winter cooling by 1 month
  - Delays spring warm-up
- Affected by the Polar Jet
Vegetation

- Vegetation-Soils-Climate are closely linked
Tundra

- Land too cold for trees
  - In the north, at altitude, in exposed places
- grasses, sedges, heath, lichen, moss, dwarf trees
- Vascular plants slow-growing, toxic to grazers
  - So caribou eat the lichen
I'm in ur tundra
Eatin ur marmots
Canada's forest regions

- Western Mountain Forests
- Boreal Forest
- Mixed Forest
- Forest/Tundra
- Grass
- Pacific Maritime Forest

The Pacific Maritime Forest is the largest forest biome in Canada, covering over 70% of the country. It is home to diverse flora and fauna, including the boreal forest to the north and the southern coniferous forests to the south. The Pacific Maritime Forest is characterized by its coastal location and is heavily influenced by oceanic climate patterns.

Canada's forest industries support over 80,000 jobs and contribute over $15 billion annually to the national economy. The forest industries are a major contributor to the country's GDP, with exports valued at over $32 billion.

2011: The year Canada's forest industries faced challenges due to severe drought and wildfires, leading to a significant decrease in timber harvests.

- 94 percent of Canada’s forests are publicly owned, but 52 percent of the harvested timber is under logging tenures.

The forest industries play a crucial role in the country's economy, providing jobs and supporting rural communities. However, they also face challenges related to climate change, wildfires, and sustainable management practices.
Boreal Forest/Taiga

• Dominated by conifers, needle-leaf trees
  – spruce, fir, balsam, pine
  – some broadleaves
• slow-growing
• Fire is important
Muskeg
Broadleaf & Mixed Forest

• Eastern Canada
• Mixed broadleaves and conifers
  – Conifers on sandy soils
  – Maples, beeches on clay soils
  – Swamps too
Prairie Parkland

- Western Interior
- Where boreal forest mixes with prairies
  - Trees dominated by aspens (poplar)
  - Tall grass prairie species
Hadashville MB
Coastal Forest

- Western Canada
- Dominated by evergreens
- Wet climate
  - Temperate rainforest
Montane Forests

• In the Cordillera
Grasslands

• Mainly western interior
• Dry climate, warm summers
• Short grass in dry south, tall grass in wetter north
  – Some characteristic animals
Palliser’s Triangle
Wetlands

- Large areas of Low relief, Poor drainage
- Waterlogged soils with slow rates of decomposition
- Vast areas of organic accumulation
- Canada has 25% of the world’s wetlands, covers 14% of the country.
Labrador
Coastal marshes, Goose Bay NL
Climate Change

• Canada sets a bad example for greenhouse gas emissions
  – Heavy consumer of fossil fuels, producer of fossil fuels

• Huge amounts of carbon are tied up in Canadian forests, wetlands
  – They might dry out, burn, accelerating global warming
  – A carbon ‘bomb’?
Water Resources

• Canada has the third largest fresh water supply (after Brazil and Russia)
• Canadian rivers discharge 7% of the world’s renewable fresh water supply
• 99% of Canada’s fresh water is in lakes
  – 2 million of them, more than anyone else
• The Great Lakes have 18% of available global fresh water supply
  – America is next door, and thirsty
Conclusions

• Canada is Continental
  – affects climate, geology
• Canada is Northern
  – affects climate
• Canada’s physical geography influences its human regions:
  – Only 8% of the surface area can be farmed