

# CHEM 9.5.1 REPLACING NATURAL RESOURCES

Industrial chemistry processes have enabled scientists to develop replacements for natural products

1.1 Discuss the issues associated with **shrinking world resources** with regard to **one identified natural product** that is not a fossil fuel, identifying the **replacement materials used** and/or **current research** in place to find a replacement for the named material

- **Fertilisers** needed as living things require **nitrogen** – plants get this from **ammonium and nitrate ions** in soil
- **Natural fertilisers**:
  - **Clovers** grown as their roots have **nitrogen-fixing bacteria** (nitrogen molecules to compounds)
  - **Saltpetre (sodium nitrate)** deposited in northern Chile
  - **Guano** from sun-baked **bird droppings** (nitrates and phosphates), e.g. Peruvian coast and from bats
    - **From 1840s** guano traded worldwide
    - **1850s Britain** controlled trade, **1856** 50 guano islands became **US** property
    - **1970s** depletion of organic guano
    - **After 1970s**, mining of saltpetre
- Synthetic fertilisers:
  - **Haber process** nitrogen and hydrogen produced ammonia
  - **Oswald process** ammonia produced **nitric acid**
  - **Nitric acid** reacts with ammonia to form **ammonium nitrate**, replacement for organic fertilisers
    - $NH_3(aq) + HNO_3(aq) \rightarrow NH_4NO_3(aq)$
  - Allowed Germany to stop relying on imports from **Chile** – esp. in **World War I** (see 9.4.2)

1.P1 Identify data, gather and process information to identify and discuss the **issues associated with the increased need** for a natural resource that is not a fossil fuel and **evaluate the progress** currently being made to solve the problems identified

- Continued use of **fertilisers** would cause:
  - Less efficient environment if clovers are planted
  - Exploitation of cheap labour in mining saltpetre
- **Generally**, issues with increased need include:
  - Increased **demand** for the product (temporarily) as more supply available
  - **Price** of natural resource increases
  - Natural resources **become depleted**, and natural resource unable to keep up with demand
  
  - **Greater reliability** and **consistency** of supply of product
  - **Cheaper**, more **available** synthetic product