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ENVIRONMENTAL SCIENCE FOR THE EUROPEAN REFINING INDUSTRY

Ecosystem Services and the European refining sector

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Introduction

- Biodiversity and Ecosystem Services
- Why CONCAWE is looking at Ecosystem services?
- What potential impacts are being assessed
- What steps are currently being taken by CONCAWE
- Links to other industry activities
- Next steps
- Summary

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Biodiversity and Ecosystem Services

What is biodiversity?

- "All ecosystems, species and genes, and the ecological processes that support them."

How much biodiversity is there?

- There could be anywhere between 5 million and 100 million species on the planet, but science has only currently identified about 2 million.

Why are these important?

- Biodiversity is essential to maintain healthy ecosystem functioning
- Ecosystem services are essential and some would argue are key to the very existence of 'life on earth'

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EU initiatives to protect biodiversity

EU Biodiversity strategy to 2020:

- Highlights the value and importance of ecosystem services in providing renewable resources and recognises that the ecosystems from which these resources are derived are, in many instances, already severely degraded and continuing to be so.
- Establishes a milestone that by 2020 it will assess the economic value of ecosystem services, and promote the integration of these values into accounting and reporting systems at EU and national level by 2020.
- Establishes that by 2020 the loss of biodiversity in the EU and the degradation of ecosystem services will be halted and, as far as feasible, they will be restored while stepping up the EU contribution to averting global biodiversity loss.

What does this mean in reality and will it be a major impact to our industry?

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Other Global Initiatives to protect biodiversity

- **Convention on Biological Diversity (CBD)** and its 2011-2020-Strategic Plan for Biodiversity.
  - The strategy included the Aichi Biodiversity Targets which are among others:
    - By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.
    - By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.
  - the CBD works within the United Nations system to contribute to the achievement of the Millennium Development Goals (MDG)
- Tools:
  - **The Economics of Ecosystems and Biodiversity (TEEB)** is a global initiative to highlight the growing cost of biodiversity loss and ecosystem degradation.
  - **System of Environmental-Economic Accounts (SEEA)** revised by UN Statistics Division.
    - In July 2011 the European Parliament and Council adopted the first EU Regulation on environmental accounts which requires all Member States to compile annual data for three modules in a first stage that **will be extended to environmental goods and services in the future**.

Need to assess potential impact of any accounting measures on our sector

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Relevance of ecosystem services to industry

- Biodiversity and protection of ecosystems is increasingly being viewed as an important issue for industry because:-
  - Recently 50% of corporate executives stated that biodiversity is one of the top 10 issues on their agendas (McKinsey, 2010)
  - IPIECA has been addressing biodiversity issues since 1992 and in 2002 formed a Biodiversity Working Group (BDWG) with the International Association of Oil and Gas Producers (OGP). It has since produced guidance on how ecosystem services that are relevant to upstream oil and gas developments can be identified along with how the risks and opportunities can be managed by operators.
- Oil industry focus has been on upstream operations but there is a need to extend to the Downstream Oil Industry
- Downstream faces difference challenges as these are existing assets

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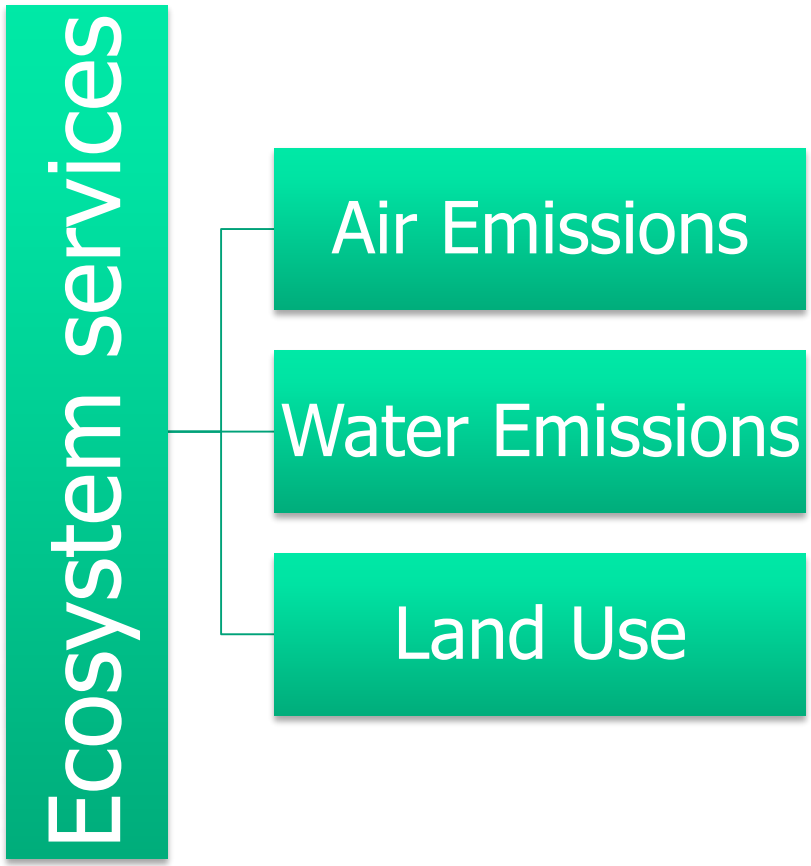
Concawe work on Ecosystem Services



Evaluation of the impact of procurement of raw materials and product use is outside the scope of the current activities

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Ecosystem Services and Air Emissions

- The potential impact of air pollution is short as well as long-range and, through reaction and transformation in the atmosphere.
  - Air pollution affects ecosystem services, either positively (e.g. eutrophication can lead to faster growth of trees and thereby carbon sequestration) or negatively (e.g. loss of rare plants in eutrophied ecosystems)

- Modelling the effects of air pollution on ecosystems requires modelling of the causal chain:

- Ecosystem responses to acidifying and eutrophying components are relatively well established. Nevertheless, there remain a important uncertainties:

  1 - Air pollution affects **different organizational levels** of biological systems, increasing the complexity of the dose-response relations

  2 - Effect of **multiple pollutants,** which may reinforce or reduce one another

  3 - Lack of information on pollutant, plant physiological and plant community **thresholds**

  4 - Biotic and abiotic factors in ecosystems change significantly over time due to natural variations. These variations obscure the effects of pollutants and other stressors.

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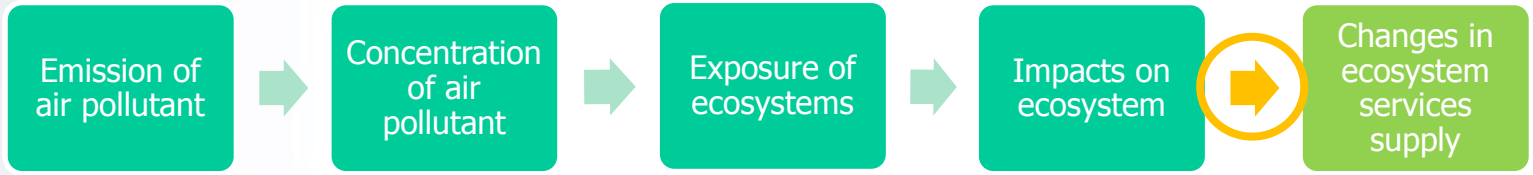
Ecosystem services and Air Emissions

- Once specific changes in ecosystem state as a function of changes in air pollution levels are understood, these changes need to be linked to changes in the supply of ecosystem services.



- No European models available yet to link ecosystem changes to changes in the supply of different ecosystem services (although model for specific services exists).
- This step is a lot more complex for semi-natural and natural ecosystems compared to croplands.
- Changes in ecosystem services:
  - Depend on different stressors (air pollution, water pollution, resource harvest rates, etc.)
  - Are variable due to variations in ecological processes, and strongly depend on ecosystem management.
  - It is often very difficult to single out the impact of one specific pollutant and link this to ecosystem services supply.

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Land use and other factors

- Within their site boundaries EU refineries occupy a total land area of approximately 200 square kilometres, corresponding to around 0.005% of the total EU land area. Compared with some other sectors of the economy (e.g. agriculture and forestry) this is very small.
- However:
  - transportation facilities to bring labour and resources to and from the site and the needs of employees will dictate that further land use will be required to support the workforce.
  - The sourcing and utilisation of raw materials, including water, and the distribution and sale of products will further extend the sphere of influence and operation of the site will result in waste products and effluents that will require treatment and/or disposal, often outside the site boundary.
- Such impacts need to be quantified and put into perspective

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Land /Opportunities for the downstream oil industry?

- In spite of the small land area involved there are opportunities for the oil refining industry.
- Within the confines of a refinery site redundant and marginal areas would be ideal wildlife refuges as the low level of disturbance can positively enhance the value of the area for wildlife.
- Constructed site facilities such as wastewater bio-treatment lagoons for effluent treatment can add to this value still further.
- Remediation strategies could be based on natural attenuation/minimal disturbance
- Assuring feed stocks are appropriately sourced
- Designing retail facilities to minimise impact on biodiversity

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Enhancement of facilities

- CONCAWE is in a good position to play a coordinating role in developing the necessary understanding in relation to refinery sites operated by its members within Europe and an action plan to achieve this needs to be developed.
- The tools and skills required to manage refinery sites and operations in such a way that biodiversity and ecosystem services are maintained or actively encouraged already exist and so the need for further investment in this area is likely to be minimal.
- There is also much to be learned from practical work already carried out in this area, for example, in relation to site remediation which has been ongoing for many years.
- Experience and skills developed in relation to conservation and habitat restoration and management are also widely available and can be used in the development of a strategy.

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Water emissions from production of oil products

- There is a need to assess the potential impact on ecosystem services related to the refining of oil and production of petroleum products
- However, there is limited knowledge regarding how such assessments can be undertaken, quantified and communicated
- Therefore CONCAWE is working with ECETOC to assess impact of 'chemical' emissions on ecosystem services
  - This is based on adapting guidance for crop protection chemicals
  - Includes a case study for an oil refinery
  - Will assess how existing chemical and other regulatory controls 'already provide' protection of ecosystem services
  - May identify if there are ecosystem service providing units (SPUs) which are not explicitly covered/protected by existing controls
- Progress is being made but the output from this activity will only represent the first step in a long and complicated process

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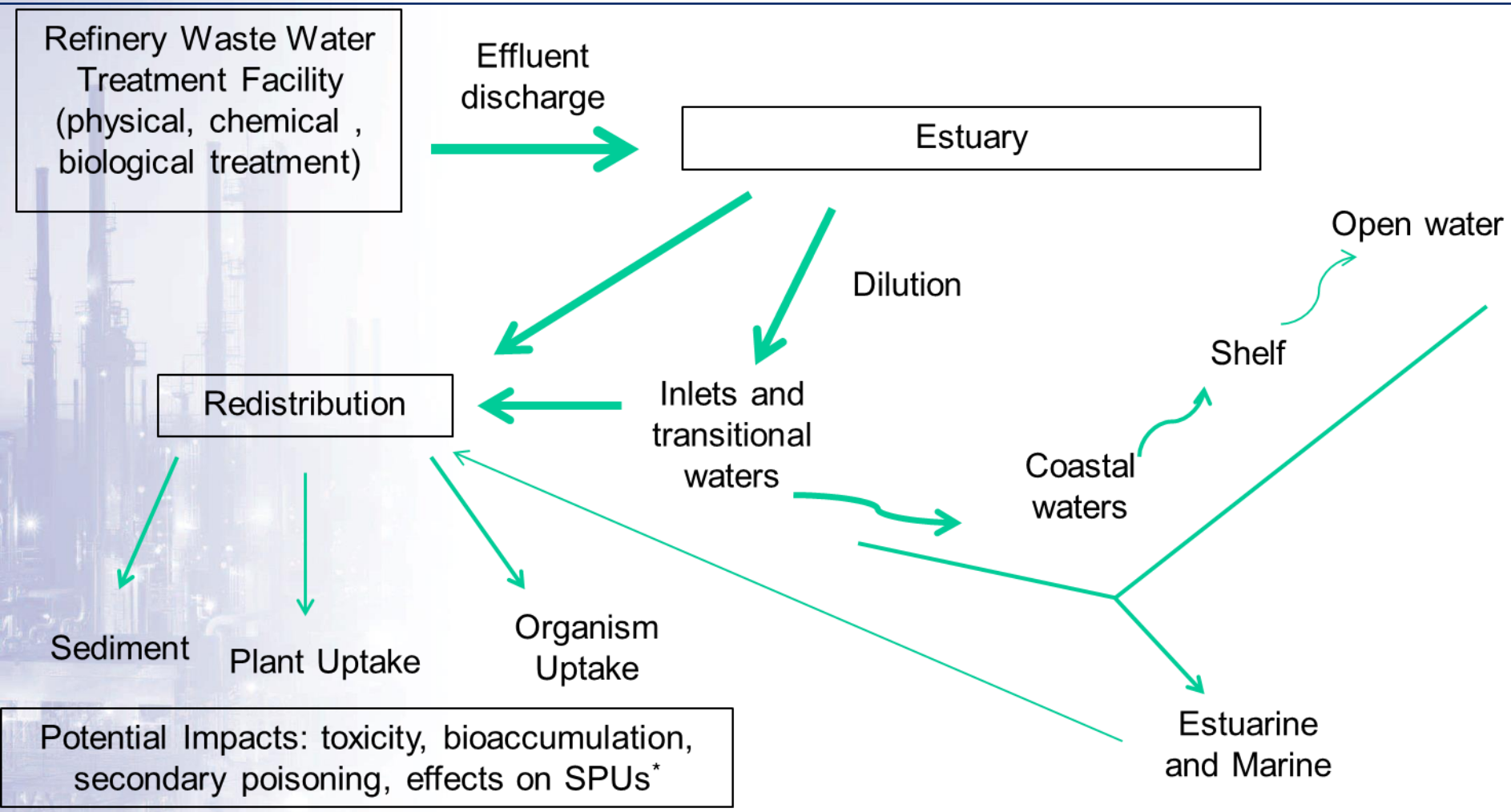
Oil refinery discharge into an Estuary



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Existing regulations and protection of biodiversity

- Currently seen that there are 3 levels of environmental legislation which can 'protect' biodiversity.
  - Prospective environmental risk assessment (ERA) of chemicals (e.g. REACH).
  - Regulations which focus on chemicals requiring Prospective ERA and/or retrospective environmental surveillance, monitoring and impact (e.g. Industrial Emissions Directive).
  - Regulations which include retrospective environmental surveillance, monitoring and impact and provide a 'safety net' (e.g. Water Framework Directive).
- The challenge is to assess if these provide adequate measure to protect biodiversity.

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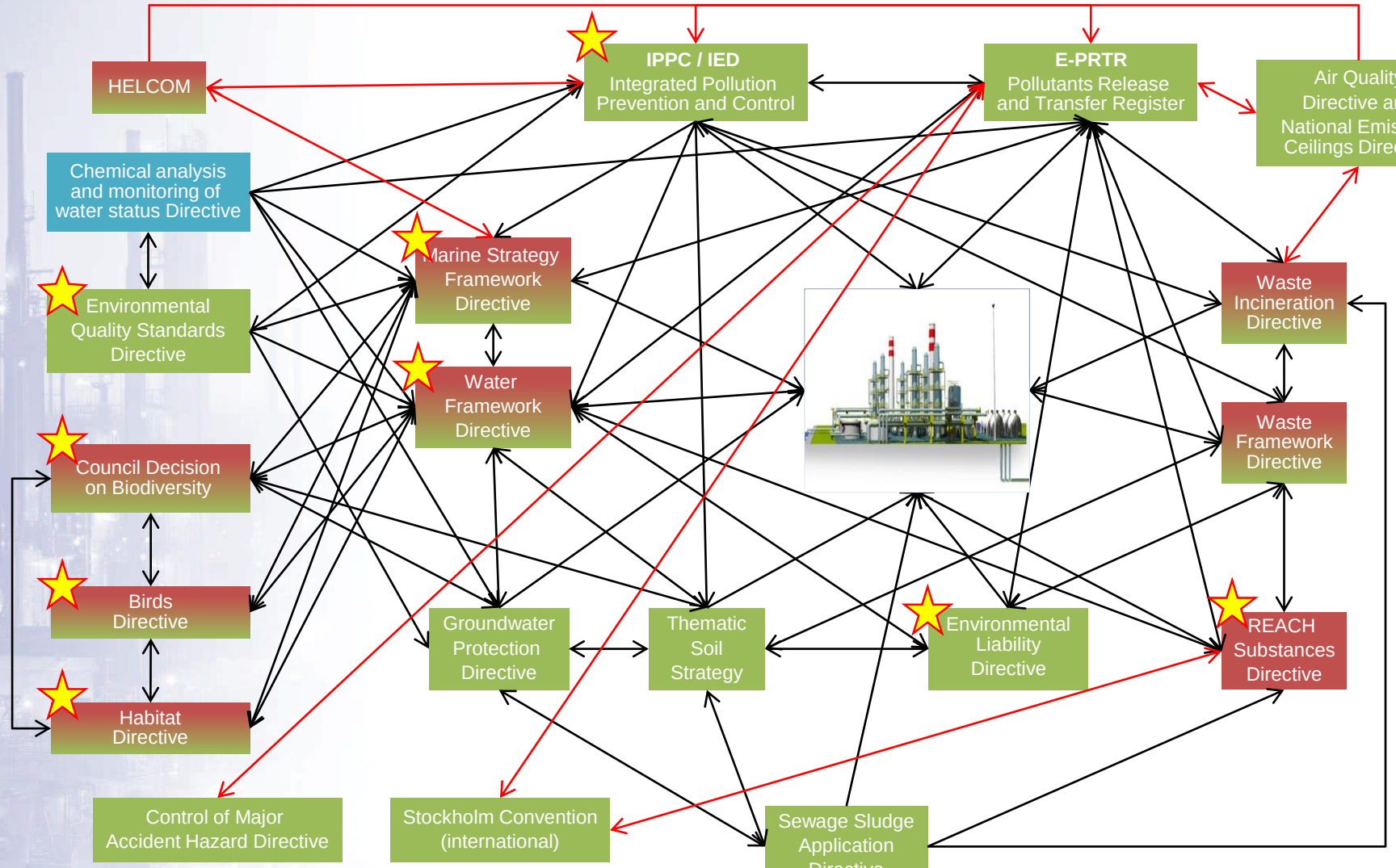
Snapshot of EU Legislative Environment



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Red = prospective risk assessment
Green= retrospective (surveillance) assessment

Particularly relevant for Ecosystem services

Existing information related to emissions

- CONCAWE has undertaken-
  - regular surveys and therefore has a good understanding of what is being emitted by the European Refining Sector
  - a recent waste survey and will be in a better position to asses any issues arising from waste disposal
  - biologically based whole effluent assessments which indicate refinery effluents are unlikely to have significant impacts on biota
  - Sensitivity analysis of retail sites to assess those which may have the greatest potential to impact on ecological receptors
- Some oil refineries have undertaken environmental surveys which indicate that their discharges do not have a significant impact
- Information from River Basin Management Plans 'indicates' that most oil refineries are unlikely to have major impacts on biodiversity

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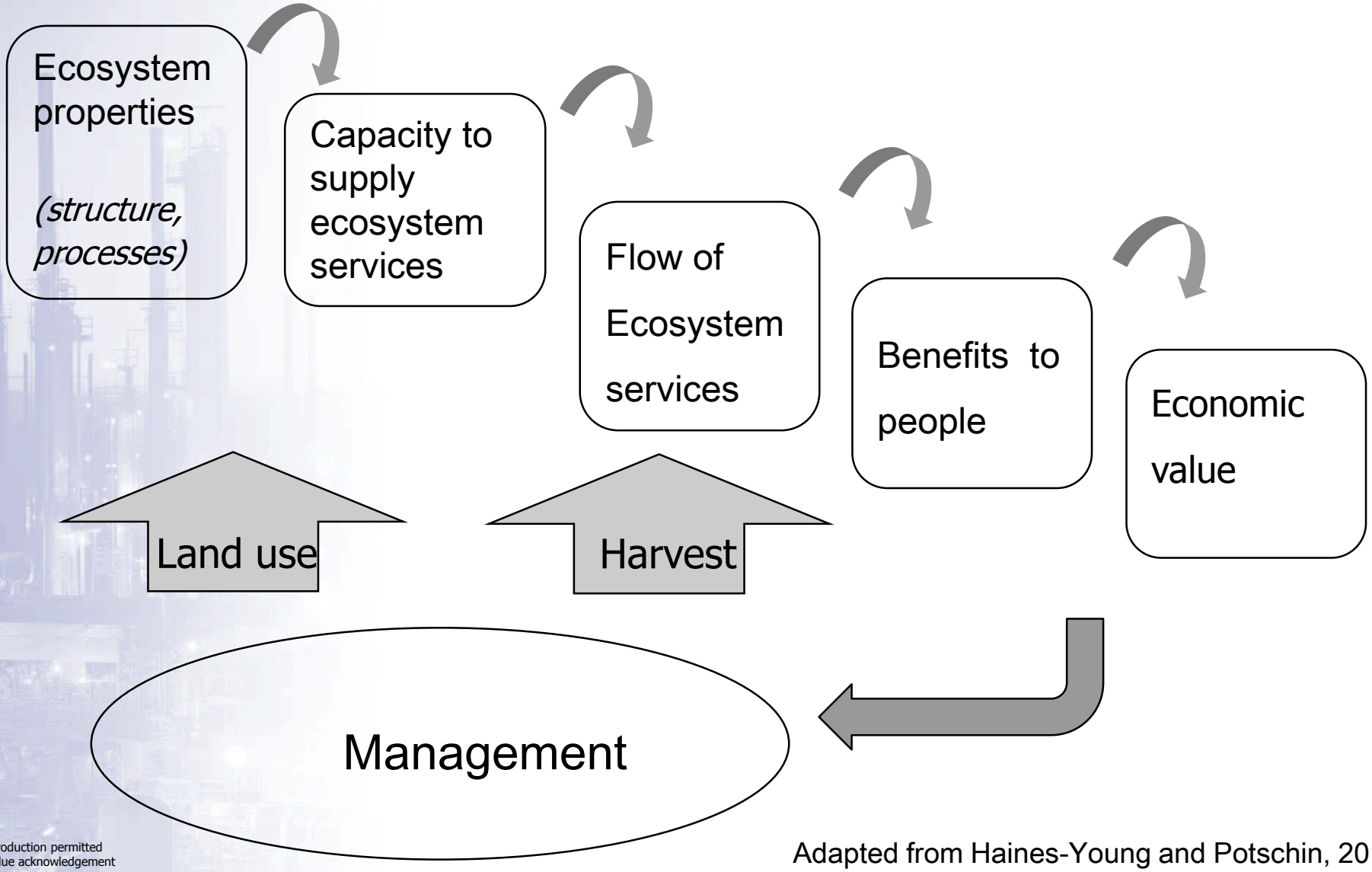
Valuation of ecosystem services



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Adapted from Haines-Young and Potschin, 2010

Valuing Ecosystem Services

Two broad approaches:

- Valuation of changes in ecosystems and ecosystem services supply (e.g. as a consequence of management)
  - ➡ valuing marginal changes using a welfare economics approach
- Valuing stocks and flows of ecosystem capital with an accounting approach ('natural capital accounting')
  - ➡ valuation of the contribution of ecosystems to economic production using a national accounts approach

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Valuation methods

- Some ecosystem services can be valued on the basis of the market price of the benefits they generate (as in crop production, timber production, tourism sector)
- The price of other ecosystem services cannot be observed in the market and non-market valuation techniques need to be applied
  - E.g. the travel cost method which estimates the value of recreational experiences
- There is increasing experience with valuing ecosystem services (with both approaches), as also reflected in international assessments (Millennium Assessment, TEEB, IPBES)

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Next steps

- There is a need to complete the ECETOC report and promote the concepts to gain credibility in the acceptability of their approaches regarding impacts of petroleum products on ecosystem services

- Need to develop an approach to assess how to use existing air and water emissions data in the context of assessing potential impacts (or lack thereof) on ecosystem services

- A much greater challenge for the industry will be to determine how the developing systems for measuring and accounting for the value of biodiversity and ecosystem services can be applied to downstream operations.

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Conclusions

- There are potential opportunities to enhance biodiversity and ecosystem services at oil refinery locations.
- Ecosystem services analysis is a rapidly developing field that is increasingly considered in the European policy arena.
- For CONCAWE ecosystem services are relevant with regards to in particular (regulations for) water management, and emissions to air.
- CONCAWE has a lot of data but these needs to be interpreted with respect to potential impacts on ecosystem services.
- In valuing ecosystem services, a thorough approach is required, including both positive and negative effects of policy options, and including appropriate uncertainty and sensitivity analysis.

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QUESTIONS?

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