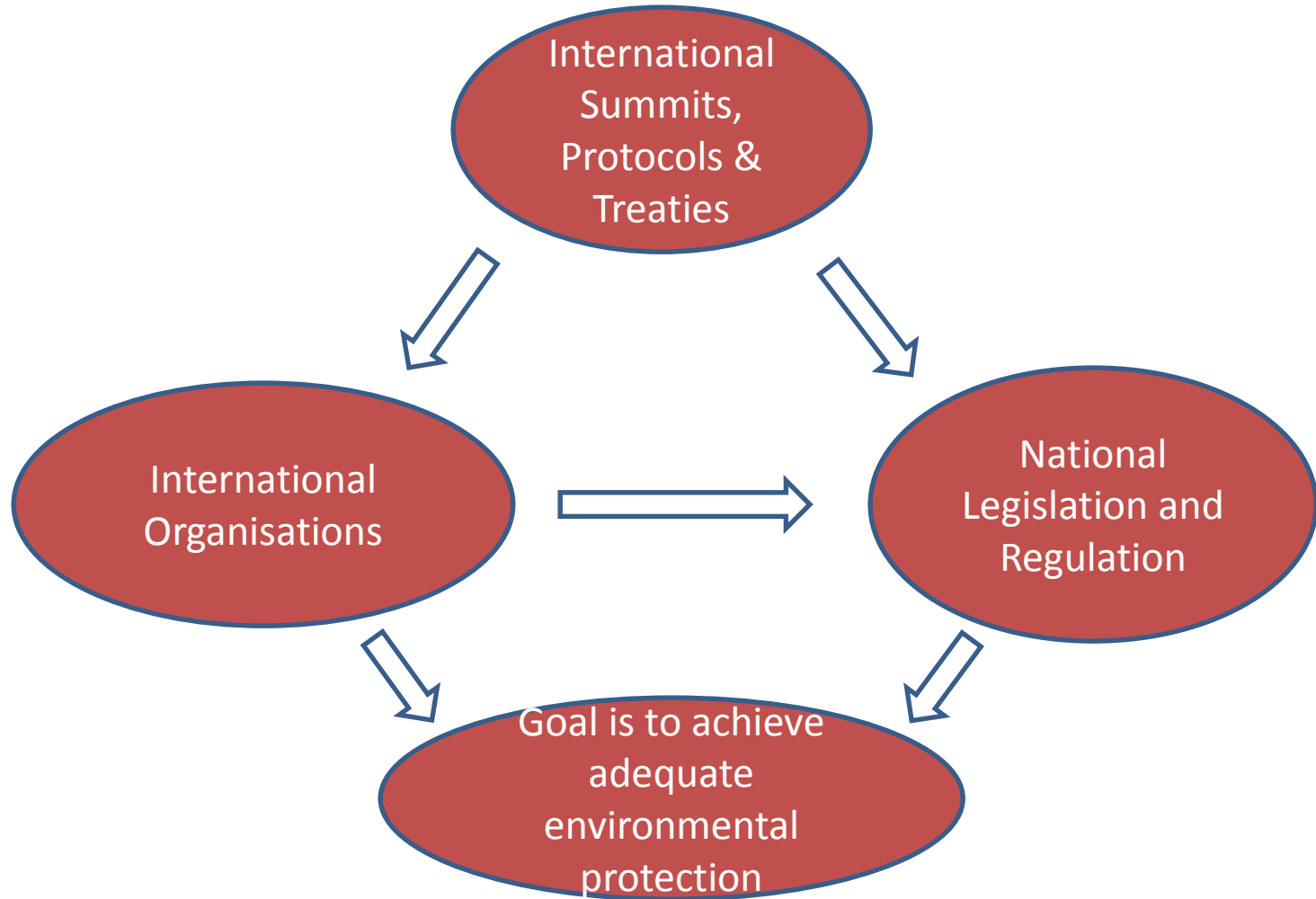


Application of radiological protection measures to meet different environmental protection criteria

David Copplestone



Environmental Protection Drivers



Outcomes of Summits and Conventions

RAMSAR Convention 1971: an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources

RIO 1992: established a framework for future development of policies to address environmental protection and socio-economic development such as climate change and biological diversity

KYOTO adopted 1997: set legally binding targets for 37 industrialised countries and the European community for reducing greenhouse gas (GHG) emissions.

Examples of National Environmental Policies

Australia: Environment Protection and Biodiversity Conservation Act 1999 provides a legal framework to protect and manage flora, fauna, ecological communities and heritage places.

New Zealand: “Environmental Governance – Resource Management” is the main legislation that details how the environment should be managed

China: Environmental Protection is enshrined in law to protect and improve the environment for people and ecology; prevent / control pollution; integrate the environment with economic and social objectives.

USA: Environmental policy seeks to regulate activities that impact on the environment, protecting the environment for future generations, yet mitigating commercial impacts on industry.

Protection Goals

- A condition or state desired to be brought about through a course of action program. They are usually **qualitative statements** that provide direction for plans and projects. Goals are **not specific numerical limitations, but conditions or states** which can be obtained through careful planning and implementation.

Application of protection goals?

Environment:

Clear goals shape Swedish environmental policy

..... The overall **goal** is to pass on to the next generation a society in which the major environmental problems have been solved.

↓ Sustainability

→ Blog

→ Facing the future

→ Equality

→ Government & politics

→ Labor market

→ Immigration




Sweden is ranked eighth in the world in terms of ecological farmland.
Photo: Yulia Usova / Image Bank Sweden

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Swedish Institute

Contents:

Carbon dioxide emissions in

Application of protection goals?

“The **water use goal** for the fishery, established by the Hamilton Harbour Stakeholder Group, is "that water quality and fish habitat should be improved to permit an edible, naturally-reproducing fishery for warm water species, and water and habitat conditions in Hamilton Harbour should not limit natural reproduction and the edibility of cold water species."

Issues

- Aspirational in nature
- Often do not explicitly mention radioactive substances, ionising radiation or even chemicals
- Consider 'environmental impacts' in broadest sense
- Need to define criteria for assessment

International Basic Safety Standards

- Protection of people and the environment
 - Prevention of radiological effects on human health and on flora and fauna.
 - Adopt an integrated perspective to ensure the sustainable use of natural resources for agriculture, forestry, fisheries and tourism - now and in the future.

2007 ICRP 103

Environmental protection objectives

ICRP's environmental protection objectives:

Prevent / reduce the frequency of deleterious radiation effects to a level where they would have a negligible impact on:

- the maintenance of biological diversity
- the conservation of species
- the health and status of natural habitats, communities and ecosystems

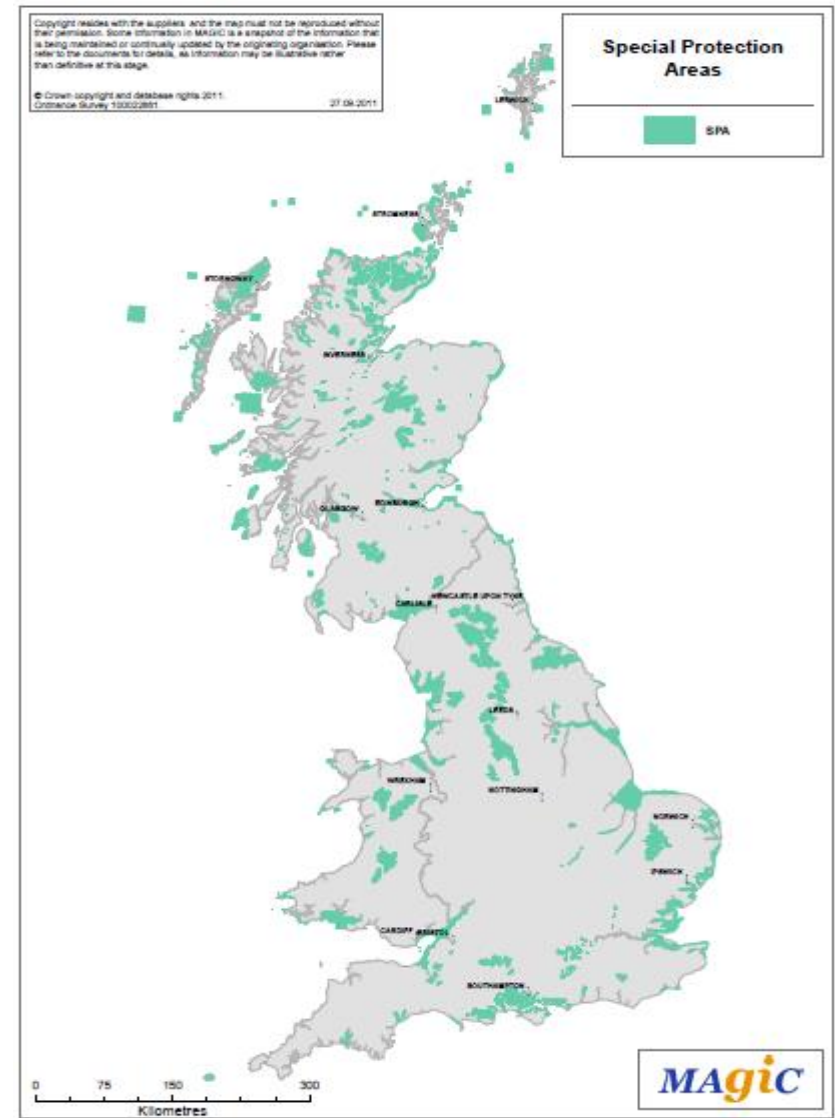
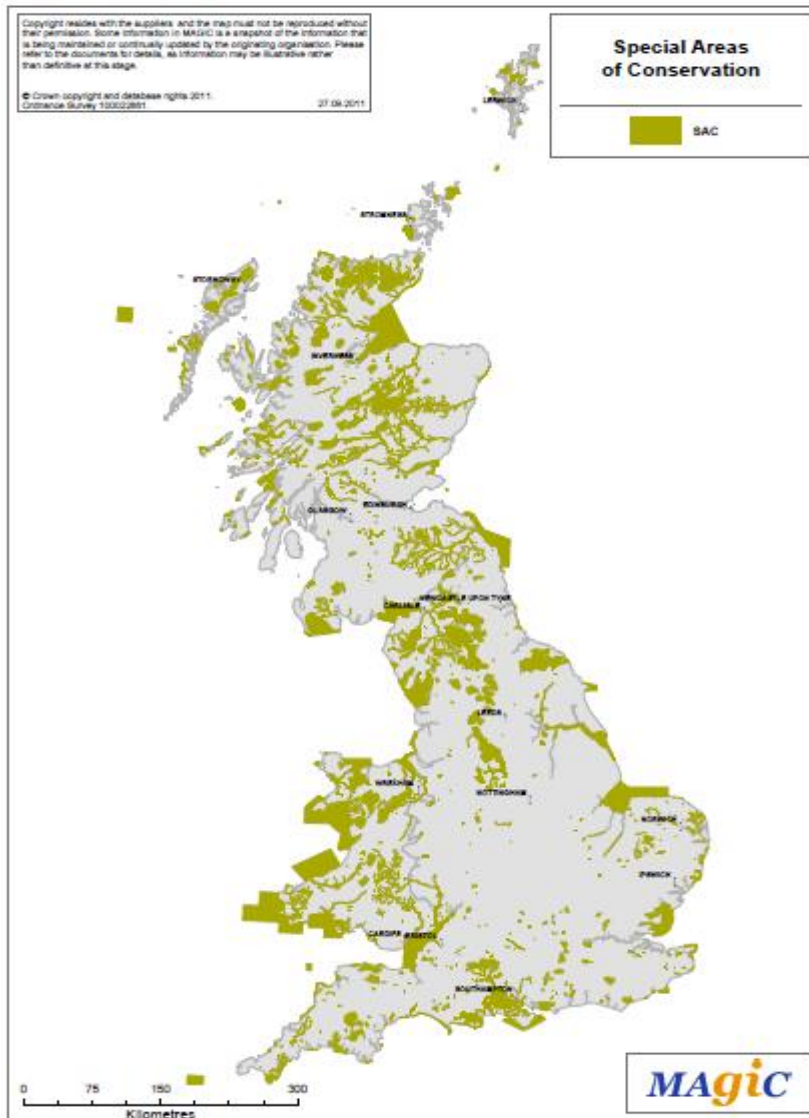
EU Directives & the UK

Selection of key directives incorporated into UK law:

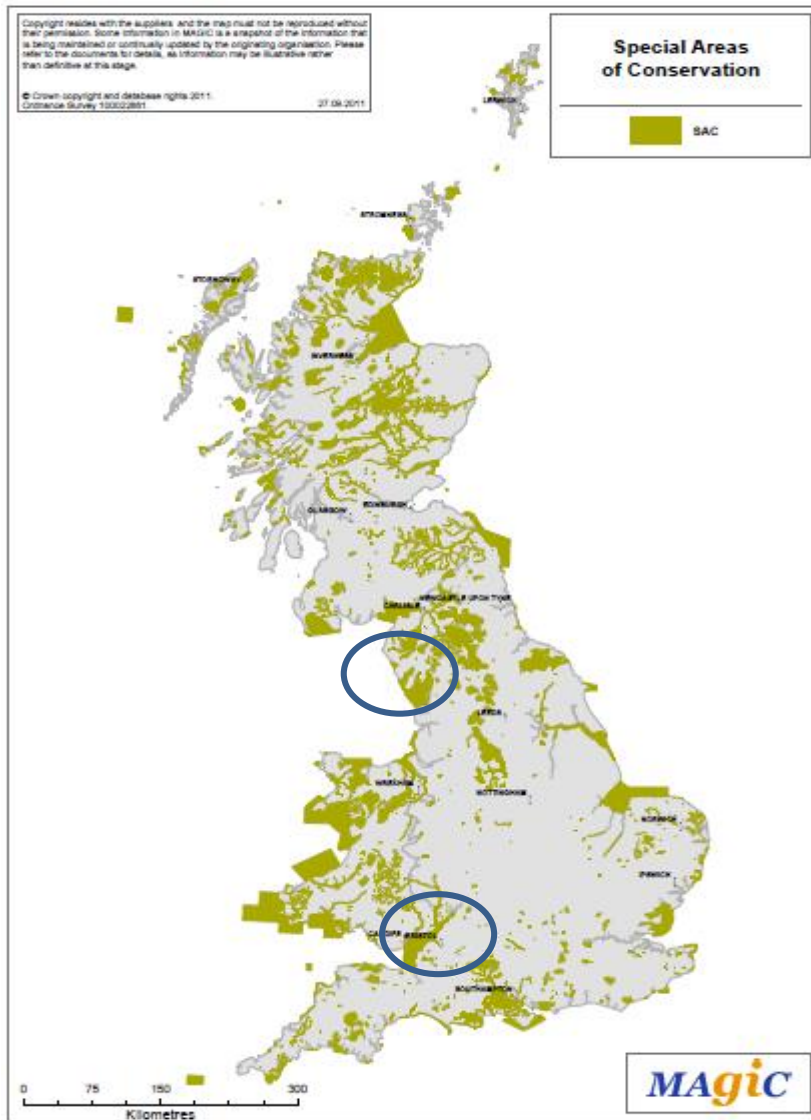
- Environmental Damage (Prevention and Remediation) Regulations, 2009 (amendment in 2010)
- Integrated Pollution Prevention and Control Directive, 2008
- **Habitats Directive (Conservation of Habitats and Species Regulations 2010)**



Habitats & Wild Birds Directives



Habitats & Wild Birds Directives



UK Environment Agencies

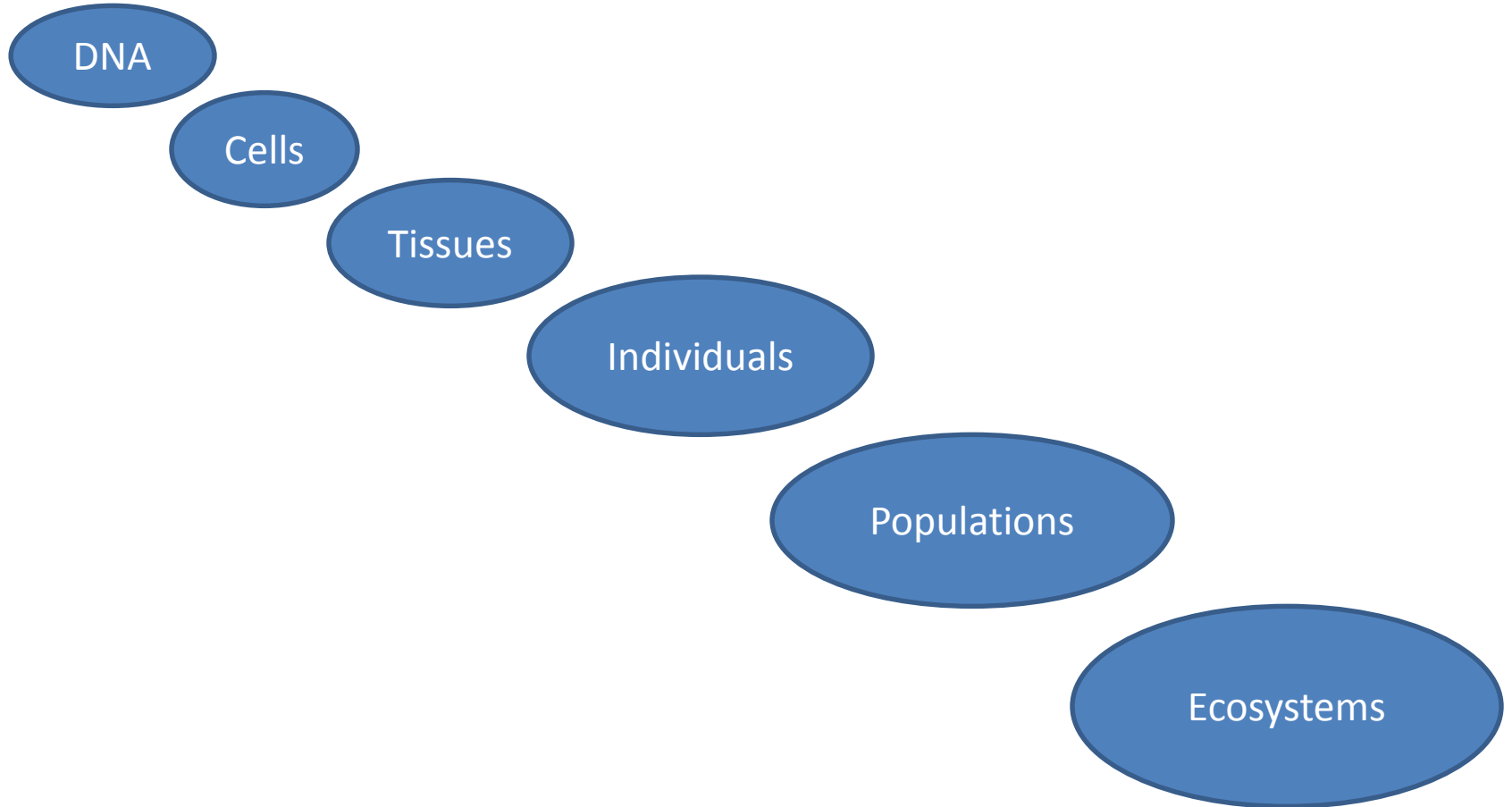
- Have a duty to comply with the EU Birds and Habitats Directives
- There are obligations to review:
 - Existing authorisations
 - Existing or new
 - Ensure that no authorised activity or permission results in an adverse effect, either directly or indirectly on the integrity of identified European sites (Natura 2000 sites)

Pressure is from conservation not radiological protection

So...

The key is to **DEMONSTRATE** environmental protection from ionising radiation

ICRP Approach



Environmental Protection Approach

Individual organism data collection of reference organisms may yield results that are too restrictive to one type of species and are unable to be translated into a wider environmental context

An Ecosystem approach would allow analysis of the properties of ecological systems and particularly the interactions among the various components, resistance and resilience to stressors and effects up and down the trophic levels

Ways to assess goal achievement

- Biological surveillance e.g. Monitor population parameters like population density, age distribution, sex ratio, biodiversity index etc.
- Monitor media activity concentrations
 - Relatively straightforward and possibly conducted within existing monitoring programmes
 - Monitor activity concentrations in biota
 - But how if/when the species is protected?

Table 2. Numerical values (dose rates or sediment concentrations) proposed by various authors as relevant for protection of populations. Note that the meaning and intended use of the values differ.

	NCRP (1991)	IAEA (1992)	UNSCEAR (1996)	Environment Canada (2003)	ERICA ^a	ICRP (2008)	Thompson <i>et al</i> (2005) (Bq g ⁻¹)
	$\mu\text{Gy h}^{-1}$						
Terrestrial							
<i>Plants</i>							
Reference pine tree ^b		400	400	100	10		4–40
Reference wild grass							40–400
<i>Animals</i>							
Invertebrates		40	40–100	200	10		
Reference bee							400–4000
Reference earthworm							400–4000
<i>Birds</i>							
Reference duck							4–40
<i>Mammals</i>							
Reference deer				100			4–40
Reference rat							4–40
Aquatic							
<i>Freshwater organisms</i>							
Algae	400	400	400	100	10		
Macrophytes				100			
Benthic invertebrates				200			
²²⁶ Ra							0.6
²¹⁰ Pb							0.9
²¹⁰ Po							0.8
Reference frog							40–400
Fish				20			
Reference trout							40–400
<i>Marine organisms</i>							
Reference crab	400		400		10		400–4000
Reference flatfish							40–400
Reference brown seaweed							400–4000
<i>Deep ocean organisms</i>		1000			10		

^a Garnier-Laplace and Gilbin (2006), Garnier-Laplace *et al* (2008).

^b Reference 'organism type' refers to the ICRPs reference animals and plants.

Protection at community or ecosystem level



Population status of species typical of the ecosystem



Key biological parameters affecting population status of typical species



Concentrations of chemicals likely to affect such biological parameters in such types



Typical biotic types of major ecosystems

Protection at community or ecosystem level



Population status of species typical of the ecosystem

Representative Organisms



Key biological parameters affecting population status of typical species

(Mortality, morbidity, reduced reproductive success, chromosomal damage)



Derived Consideration Reference Levels

Concentrations of chemicals likely to affect such biological parameters in such types



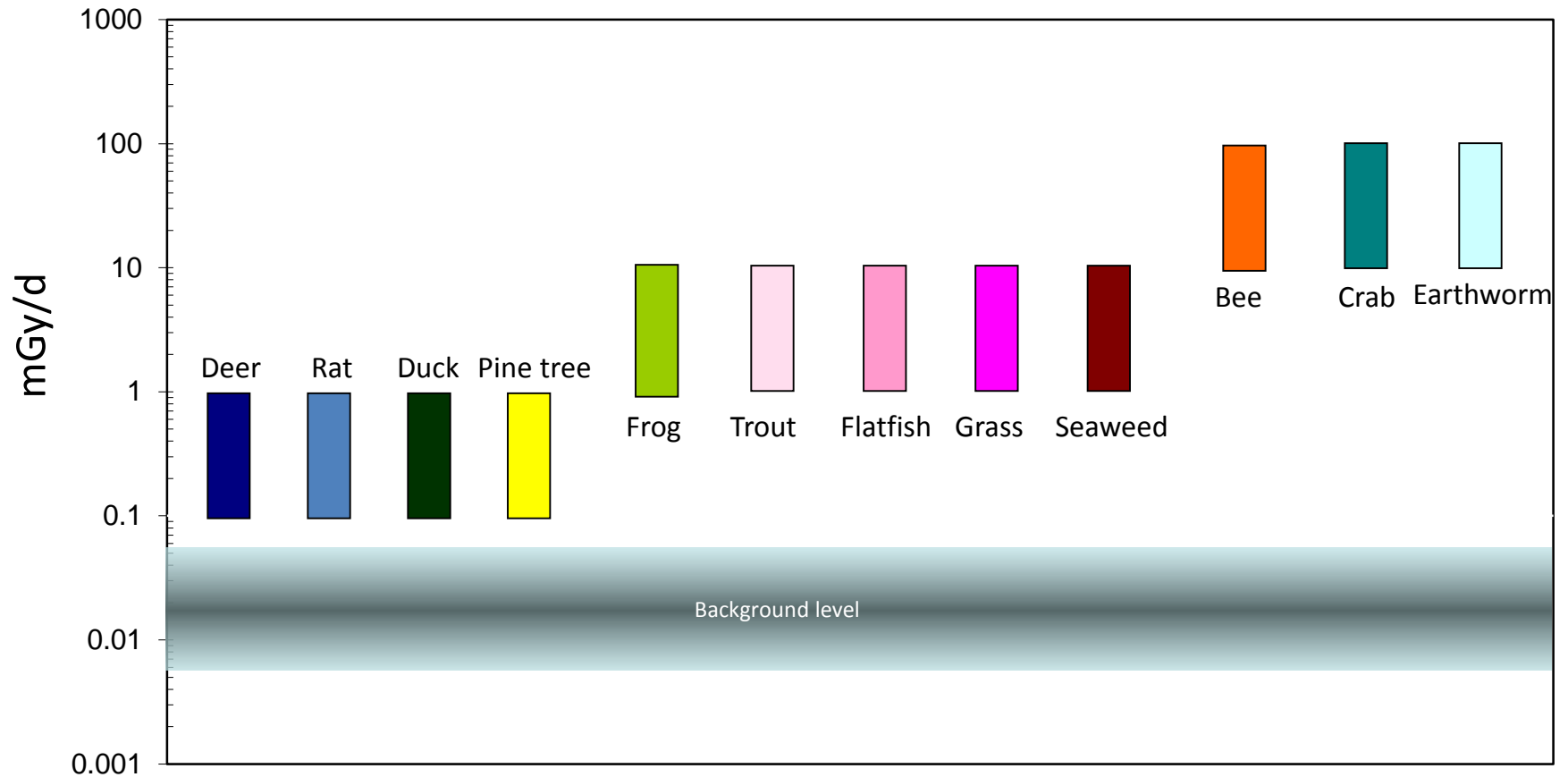
Reference Animals and Plants

Typical biotic types of major ecosystems

Derived Consideration Reference Levels

“A band of dose rate within which there is likely to be some chance of deleterious effects of ionising radiation occurring to individuals of that type of RAP (derived from a knowledge of expected biological effects for that type of organism) that, when considered together with other relevant information, can be used as a point of reference to optimise the level of effort expended on environmental protection, dependent upon the overall management objectives and the relevant exposure situation.”

Derived Consideration Reference Levels (DCRLs)



Representative Organisms

- A particular species or group of organisms selected during a site specific assessment. In many cases the representative organisms chosen for this purpose may be the same as, or very similar to, the Reference Animals and Plants; but in some cases they may be very different.

Differences between ROs and RAPs

- From ICRP 108
 - Biology
 - Exposure pathway
 - Dosimetry (*quantifiable*)
 - Effects (*likely to be similar*)
 - Consequences

Concluding remarks

- Environmental protection can be regarded as
 - Threat to business due to over regulation and additional costs
 - Advantageous addressing the challenge of climate change
- ICRP are seeking to deliver effective and efficient assessment techniques that
 - Demonstrate adequate protection of our ecosystems
 - Benefit our economic growth and human wellbeing
 - Proportionate with the radiological risk