

Environmental impacts

Introduction

- 5.1 There was a general consensus among the views put to the committee about the environmental impact of bioprospecting. This view was that, in the Australian context, bioprospecting is unlikely to have significant negative effects. If negative impacts are expected, they can be minimised or avoided by placing conditions on bioprospectors. In addition, bioprospecting was seen as having considerable positive environmental spin offs.

Possible negative impacts

- 5.2 Being an extractive activity, bioprospecting can harm the environment.¹ The harm may come from activities such as:
- overcollecting, which is a particular danger in relation to rare and endangered species;
 - the introduction of exotic species and pathogens to habitats visited by collectors; and/or
 - the use of inappropriate collection methods that result in collateral damage to habitats or biota other than those being targeted.²

1 Australian Institute of Marine Science, Submission no. 27, p. 16; Department of Agriculture, Fisheries and Forestry – Australia, Submission no. 24, p. 12; Biotechnology Australia, Submission no. 25, p. 20.

The last point is a concern in relation to fragile ecosystems, and in marine environments where destructive collecting methods such as trawling are used.³

5.3 However, much bioprospecting involves the collection of only small quantities of material.⁴ Once the structure of any active chemical found in this material has been established, it is often possible to synthesise it without needing to make further collections from the wild.⁵ The impact of collecting can also be minimised by targeting only the most promising organisms or groups of organisms on the basis of information already available.⁶ Furthermore, impacts can be monitored.

5.4 The danger of bioprospecting to rare and endangered species is mitigated by the fact that it is likely to be impossible to guarantee future supplies of material, if positive leads are found. As CSIRO pointed out, 'any cost-benefit analysis would quickly indicate the lack of commercial opportunity'.⁷ No business would invest in biodiscovery from such material.

5.5 AIMS claimed that bioprospecting for chemical extracts can be 'almost based on a "zero impact"'.⁸ It suggested that:

... impacts on the environment from traditional bioprospecting by well trained research groups is negligible. Even recollections of kilograms to tonnes can be accommodated with appropriate preliminary environmental effects investigations, and adoption of alternate means of production [such as] aquaculture/ fermentation ...⁹

In addition to aquaculture and fermentation, plantations and cropping to produce supplies of needed materials are other means of minimising impacts on wild populations of target species.¹⁰

2 Tasmanian government, Submission no. 23, p. 3; Environment Australia, Submission no 29, p. 33.

3 Royal Society of Western Australia Inc., Submission no. 8, p. 3.

4 Northern Territory government, Submission no. 4, p. 7; Associate Professor Robert Capon, University of Melbourne, Submission no. 6, p. 5; EcoBiotics Pty Ltd, Submission no. 18, pp. 8-9.

5 Victorian government, Submission no. 34, p. 2.

6 Australian Institute of Marine Science, Submission no. 27, p. 16.

7 CSIRO, Submission no. 14, p. 26.

8 Australian Institute of Marine Science, Submission no. 27, p. 16.

9 Australian Institute of Marine Science, Submission no. 27, p. 17.

10 Environment Australia, Submission no. 29, p. 33; Biotechnology Australia, Submission no. 25, p. 20.

- 5.6** The importance of developing sustainable sources of the materials needed in the commercialisation of biodiscoveries is illustrated by experience with sourcing supplies to manufacture the anti cancer drug, taxol (Box 5.1).

Box 5.1 Taxol

Taxol is the generic trade name for the compound, paclitaxel, which has been developed from the Pacific yew tree, *Taxus brevifolia*. It is a highly complex compound which cannot be economically synthesised, but is in high demand. In 1997 it was the 30th top selling drug in the world.

Taxol is produced from the bark of trees that grow from northern California to British Columbia. The amounts of bark collected increased as the drug went into production: from 2,273-6,818 kg per year up to 1985, to 27,273 kg in 1987-8 and 1989 to supply Phase 1 clinical trials, and on to 727,273 kg in 1991 and 1992. Although environmental studies in 1990 indicated that *Taxus brevifolia* was abundant, ongoing monitoring suggested that alternative sources of taxol would have to be found.

Taxol is now obtained from the needles of another species of *Taxus*. It was sourced at one stage from India but suppliers felled the trees, selling the wood to one party and the needles for taxol production. Taxol is now sourced from Europe.

Source: K ten Kate & S A Laird, *The Commercial Use of Biodiversity: Access to Genetic Resources and Benefit-Sharing*, Earthscan Publications, London, 1999, pp. 73-4.

- 5.7** Existing legislation in many parts of Australia already addresses negative environmental impacts and is being or could be used to control bioprospecting. The Victorian government, for example, reported that 'for the most part the systems and processes required to protect biodiversity and enable the sustainable management of Victoria's flora and fauna are already in place'.¹¹ Nonetheless, a recent parliamentary committee report found some gaps in the coverage of the legislation, for instance in relation to microorganisms and terrestrial invertebrates.¹²
- 5.8** Under the Commonwealth government's EPBC Act, the requirement for an environmental impact assessment could be triggered by bioprospecting activities in relation to world heritage properties; Ramsar wetlands; listed threatened species, communities and migratory species; and Commonwealth land and marine areas. However, the Voumard report

11 Victorian government, Submission no. 34, p. 1.

12 Environment and Natural Resources Committee, Parliament of Victoria, *Inquiry into the Utilisation of Victorian Native Flora and Fauna*, June 2000, p. 314.

concluded that the existing administrative guidelines relating to this trigger needed to be amended to address impacts from bioprospecting.¹³

5.9 Once activities that impinge on these areas are referred to the Minister for the Environment, he may order:

- an assessment on preliminary documentation;
- a public environmental report;
- an environmental impact assessment; or
- a public inquiry.

The Voumard report indicated that assessment on preliminary documentation may often provide a satisfactory means of assessing the environmental significance of bioprospecting.¹⁴

5.10 The conditions attached to access permits also provide a powerful means of controlling environmental impacts, especially if they are mandatory and penalties apply to anyone who fails to obtain a permit or contravenes the collection protocols specified in the permit.¹⁵ Independent monitoring and auditing arrangements are important in this context.

5.11 The Great Barrier Reef Marine Park Authority commented in a private meeting with the committee that, in the marine environment with which it is dealing, it is very hard to know what is a reasonable limit to place on researchers' collections. Yet, as the Australian Academy of Science pointed out:

The development of Australia's bio-diversity by or on behalf of commercial users must be sustainable. This can only be achieved through ongoing intensive and exploratory research into the growth and/or maintenance of organisms either *in situ* or *in vitro*. Industry and government sectors need to provide adequate funding for this research work.¹⁶

13 Environment Australia, Submission no. 29, p. 34.

14 Environment Australia, Submission no. 29, p. 35.

15 Environment Australia, Submission no. 29, p. 35.

16 Australian Academy of Science, Submission no. 19, p. 2.

Positive impacts

- 5.12** The activity of bioprospectors has contributed substantially to what we know about Australia's biological resources.¹⁷ It has led to the discovery of new and rare species, the compilation of species inventories, the identification of biogeographic zones and biodiverse hot spots, deposits of specimens in publicly accessible collections, and taxonomic work. There are some areas in Australia where all that is known about their biota is what has been collected by bioprospectors.¹⁸
- 5.13** Under the access conditions and benefit sharing arrangements concluded with bioprospectors, the latter can be required to help build the nation's knowledge base about our biological resources. An example of this is provided by the contracts finalised by AZGU with the Queensland Museum and Herbarium (Box 5.2).

Box 5.2 Knowledge contributed by AstraZeneca R&D Griffith University's benefit sharing arrangements

Under contracts negotiated in 1993 with the Queensland Museum and Herbarium, AZGU pays a specified rate for each sample collected and a percentage of all proceeds from the commercial use of compounds obtained from the samples.

As a result of these arrangements:

- 60 new plant species have been discovered;
- 3,800 species of sponges, soft corals and ascidians have been collected, 2,000 of them being new to science;
- distribution data for these species have been assembled, including records of new populations of threatened species; and
- records of weed encroachment in native forests obtained.

Source: AstraZeneca R&D Griffith University, Submission no. 33, p. 2; Environment Australia, Submission no. 29, pp. 23, 36.

17 Biotechnology Australia, Submission no. 25, p. 19; Australian Academy of Science, Submission no. 19, p. 5; North Territory government, Submission no. 4, p. 8.

18 Australian Institute of Marine Science, Committee briefing, 3 May 2001; Environment Australia, Submission no. 29, p. 36.

5.14 Some state governments and others have suggested that the lodging of voucher specimens with museums and herbaria should be required, together with collection data and other information about the properties of the biota accessed.¹⁹ In the contract between the Antarctic CRC and Cerylid Biosciences, arrangements have been made for information derived from microorganisms by Cerylid to return to the CRC.

When the contract with Cerylid ends—I think it is three years after the end of the contract—those organisms revert to the ownership of the Antarctic CRC and, if Cerylid have not commercialised an opportunity from the organisms, then all the information that they have collected on those organisms also comes back to the CRC.²⁰

5.15 As attention world wide increasingly focused on the commercial value of biodiversity, environmentalists hoped that royalties and the payments made for access to the resources would provide a source of revenue for conservation purposes. However, as EA commented, 'given the highly speculative nature of bioprospecting, it would be imprudent to rely on fees derived from such activities to be used for conservation and/or provision of regional services'. There is also considerable variation in the value of biodiscoveries and hence the royalties that would flow from them.²¹ Despite this, some of the income from bioprospecting could be devoted to conservation research.²²

5.16 The information collected in the course of bioprospecting may make a greater contribution to conservation than any monetary returns. According to EA, 'the public good outcomes and the public good potentials of assaying our biodiversity are enormous'.²³ With better information about species and the ecosystems in which they occur, the managers of biological resources are in a stronger position to make wise decisions about conserving these resources and allowing them to be used.²⁴ At a private meeting with the committee, AIMS outlined how information collected during bioprospecting is being used to support proposals to identify habitats under threat. For example:

19 Australian Conservation Foundation and Queensland government quoted by Environment Australia, Submission no. 29, p. 36; Western Australian government, Submission no. 32, p. 4.

20 The Australian Society for Microbiology, Transcript of evidence, 25 June 2001, p. 92.

21 Environment Australia, Submission no. 29, p. 36.

22 Tasmanian government, Submission no. 23, p. 4; South Australian government, Submission no. 28, p. 6.

23 Environment Australia, Transcript of evidence, 4 June 2001, p. 72.

24 Victorian government, Submission no. 34, p. 1.

... that biodiversity is under threat is ... abundantly obvious to qualified bioprospecting teams. Sediment discharge from rivers onto the continental shelf, some trawling activity and invasion from opportunistic species introduced by shipping is having significant impact on biodiversity.²⁵

5.17 Several witnesses to the inquiry also pointed out the environmental benefits that flow from biodiscoveries. They cited as examples:

- bioremediation;
- reducing waste and greenhouse gas emissions by using biological feedstocks instead of petrochemicals for industrial production;
- improving waste and waste water management;
- increasing the efficiency with which products are produced; and
- developing crop plants that are better adapted to marginal environments or resistant to disease compared with current varieties.²⁶

The fact that many of the genetically modified organisms (GMO) that might be used in bioindustries would be contained in fermenters is an advantage in situations where GMOs are viewed negatively by the public.

Conclusion

5.18 Conservation of biodiversity is fundamental to biodiscovery and to building bioindustries based on these discoveries. If lost, biodiversity cannot be recreated. With its loss, numerous adaptations to different environments disappear. Many of these adaptations are the outcome of thousands, if not millions, of years of evolution.²⁷ They comprise a variety of successful solutions to the environmental challenges facing the organisms in which they are found. As the same challenges face humankind in its survival, the various adaptations to these challenges are potential starting points for the solution of our problems.²⁸ The conservation of biodiversity is therefore imperative.

25 Australian Institute of Marine Science, Exhibit no. 2.

26 CSIRO Submission no. 14, pp. 4, pp. 26-27; Department of Agriculture, Fisheries and Forestry – Australia, Submission no. 24, p. 13; Transcript of evidence, 2 April 2001, p. 28; Biotechnology Australia, Submission no. 25, pp. 13, 19-20;

27 Faculty of Biological and Chemical Sciences, The University of Queensland, Submission no. 26, p. 1.

28 South Australian government, Submission no. 28, p. 1.

- 5.19** The terms of reference did not include a requirement for the committee to assess the adequacy with which biological resources are being conserved in Australia, and very little information was received on this point. However, the committee did receive some comments on this topic and they are noted here.
- The Western Australian government claimed that conservation is generally under resourced in Australia.²⁹
 - While a considerable number of protected areas have been declared on land, marine biodiversity is not adequately protected.
 - Although a rich source of material for bioprospectors, microorganisms are not well protected.
- 5.20** The committee is aware that some of these issues are being addressed, for example, through the establishment of a National Representative System of Marine Protected Areas. Australia's governments are working together to set up a national system of protected areas throughout our entire marine zone. They will represent all the major ecological regions and the communities of plants and animals that they contain. The Minister for the Environment, Senator Hill, has called for an acceleration of action by all Australian governments in this effort.³⁰
- 5.21** The committee believes that it is essential that state, territory and Commonwealth conservation programs comprehensively cover Australia's biodiversity and are adequately funded to maintain it. The combination of great biodiversity and an access regime encouraging to bioprospectors promises great possibilities for economic gain from bioprospecting. Without a strong, efficient conservation effort, Australia will lose out, both industrially, environmentally and socially.

Recommendation 19

- 5.22** The committee recommends that Environment Australia give a high priority to continuing its work with state and territory governments to develop a nationally consistent approach to establishing conservation areas that comprehensively cover all species and ecosystems.

29 West Australian government, Submission no 32, p. 1.

30 Environment Australia, 'A National Representative System of Marine Protected Areas', <http://www.ea.gov.au/coasts/mpa/nrsmpa/index.html>, accessed 16 July 2001.