

12

An interdisciplinary approach

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Introduction

Because the environment is a complex, multidimensional system it gives rise to 'wicked' problems which cannot be fully understood or solved from a single disciplinary perspective, approach or method (see the Introduction for more discussion of 'wicked' problems). Although each discipline can give a partial perspective and make a contribution towards a solution, no discipline can provide a complete picture of how to shape, reshape, manage and sustain the urban, social and natural environment. Architects tell us how to design a space to meet our needs, but do not tell us about the possible effects on the local ecology. Engineers can tell us the most efficient way to transport or store water, but not the preferred way. Sociologists can tell us what particular people want, but they cannot tell us how to build it. Ecologists can describe the effects of our actions on an ecosystem, but they cannot tell us how to balance our needs and wants against those of the ecosystem. Economists can tell us what will be the most cost-effective path to take, but not what leads to the least environmental harm (see Box 12.1 for more about disciplines).

Box 12.1 What are disciplines?

It is easy to think of disciplines such as science, history and anthropology as simply bodies of knowledge – formulae, facts, theories and concepts – to be memorised for exams. But they also involve a particular way of thinking and seeing that can be used to make sense of and reshape the world. As such, other terms similar to 'discipline' include 'paradigms' (see Kuhn 1962) or 'thought-styles' (see Pohl 2011, referring to Fleck 1979).

In particular, each discipline has its own (1) subject matter: the problems, tasks, questions and issues that it is concerned with; (2) methods: the specialised tools, concepts, theories, practices and ways of thinking it uses to approach its subject matter;

Box 12.1 continued

and (3) products: the theories, constructions and knowledge that result from applying its methods to its subject matter. For example, the discipline of philosophy addresses basic assumptions and fundamental beliefs about such concepts as truth, reality, and right and wrong. Philosophers use argument and conceptual analysis to show where our core beliefs are inconsistent or unjustified; and to then produce new positions, beliefs or different ways of conceptualising the world that are more consistent and defensible. Education, on the other hand, addresses practical issues related to learning, teaching, educating and schooling. Those working in the discipline of education employ a wide range of theoretical constructs – such as 'scaffolding' and 'internalisation' – as well as empirical methods including observation, interview and classroom experimentation. These are employed to produce advice and techniques for improving learning and teaching practice for teachers, learners, classrooms, schools and nations.

Disciplines are recent developments that are neither fixed nor uniform. It was only in medieval universities that the 'study of theology and the arts became distinct from law and medicine' (Salter and Hearn 1996, p.18) and the disciplines as they exist in today's universities emerged only in the 19th century (Klein 1990, pp. 21–2; Augsberg 2006, pp. 8–9).

Disciplines have developed specialised approaches, methods and ways of thinking needed to deal with their distinctive subject matter. For example, experimentation is necessary for understanding the physical laws that govern matter, so this is the method of the biophysical sciences; but this method would not be useful for understanding human history, which requires analysis and interpretation of texts and artefacts from the past.

The creation and development of the disciplines can be understood as a process of increased specialisation. Philosophy became natural philosophy as people began to specialise in study of the physical universe. Natural philosophy became science as we discovered empirical methods that were effective at shedding light on the nature of the universe. Science became chemistry, physics and biology as the empirical methods were further specialised for the distinctive subject matters of the different sciences.

Even now, disciplines are still growing and changing. As one discipline begins to use the methods of another discipline, or applies its methods to new topics, new disciplines such as chemical engineering, biomedical engineering and landscape sociology develop.

Although we speak of disciplines as if they are uniform fields of knowledge, there are multiple subdisciplines and specialisms that make up each discipline; each with its own slightly different subject, method or products. For example, some engineering specialisms include chemical, biomedical, civil, electrical, environmental, geomatics, mechanical and mechatronics. In many disciplines there is also debate and disagreement about the nature of the discipline from within the discipline itself. For example, to what extent should sociology use numerical, quantitative methods rather than methods that are more qualitative, descriptive and open to interpretation?

Question 12.1

- (a) Which disciplines are you studying?
- (b) What is the subject matter of these disciplines? Which methods do they employ and what do they produce?
- (c) What are the subdisciplines and specialisms of these disciplines?
- (d) Is there any controversy about the appropriate subject matter or methods of these disciplines?

Controversial question 12.1

- (a) Are subject areas – engineering, commerce, history, geography – the same as disciplines?
- (b) Is every subject area one discipline? Can one subject area include different disciplines? Can different subject areas employ the same discipline?

To solve wicked environmental problems we need to take an interdisciplinary approach. We need what Howard Gardner (2006, p. 3) calls a 'synthesising mind', which enables us to see things differently so we can understand, translate and synthesise insights from a variety of disciplines; we integrate the insights to create a more sophisticated solution than would be possible from a single disciplinary perspective. For example, imagine building a bridge. This is the classic task for engineering, but it also requires an interdisciplinary approach to deal with potential consequences: for the local ecosystems (if native habitat might be destroyed); for the economic well-being of the local community (if traffic is redirected to bypass the local town); and for the world (if the bridge utilises materials that leave a vast carbon footprint, either because of the energy required to bring them to the site or to refine them). To construct the bridge, an engineer must consider the insights from ecology, sociology, ethics, economics and science, and modify the location, design and construction of the bridge so it does not affect the local ecosystem, the community or the global environment in a negative way. This process of synthesising multiple disciplines changes the perspective and thinking of the engineer and as a result changes the design of the bridge.

Scenario 12.1

- (a) As part of environmental planning, design and management, what sorts of problems might be faced, and what sorts of tasks might be undertaken?
- (b) Which disciplines might provide insights that would enable these problems to be solved and the tasks completed? Consider, for example, history,

- ecology, mathematics, science, architecture, or economics. What useful insights might they provide?
- (c) How can these different insights be combined to solve these problems and complete these tasks?

The main aim of this chapter is to equip readers with the tools for taking an interdisciplinary approach so they can deal with the complex problems that arise in human–environment interactions. These interdisciplinary tools are useful for all forms of shaping and reshaping the environment (not just university research) – corporate and public; government policy and commercial; construction and advising; generating and applying knowledge; and making decisions, planning and taking action.

The point of this chapter is practice, not scholarship – enabling readers to take an interdisciplinary approach when they research, plan, design and manage environments. Although there is a great deal written about taking an interdisciplinary approach, this chapter will not give an introduction to this scholarship, nor equip the reader to write an essay about it, although there are further readings listed at the end. Instead the chapter includes advice, guidance and multiple examples to illustrate, explain and justify an interdisciplinary approach. It also includes a range of scenarios and questions to challenge and extend readers' thinking – some of which will assist to build understanding (the questions which head sections, as well as questions throughout the chapter), while others highlight issues that are currently being debated (controversial questions) and that put readers in the midst of the thinking on this topic.

What is an interdisciplinary approach?

An interdisciplinary approach involves 'answering a question, solving a problem, or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline or profession' (Klein and Newell 1998, p. 3). More precisely, we take an interdisciplinary approach when we:

integrate knowledge and modes of thinking in two or more disciplines or established areas of expertise to produce a cognitive advancement – such as explaining a phenomenon, solving a problem, or creating a product – in ways that would have been impossible or unlikely through single disciplinary means. (Boix Mansilla and Duraising 2007, p. 219)

This might involve translating an insight about climate change from the discipline of science to politics in order to create a policy on appropriate urban development. To manage a large property with multiple users, an interdisciplinary approach could require making connections between the different perspectives on land use from the

disciplines of horticulture, agriculture and ecology. Other possibilities are balancing or accommodating the conflicting conclusions about the proposed development of a new wind farm from engineering, urban planning and biology perspectives.

An interdisciplinary approach involves three main steps: (1) identifying a broad and complex problem, issue or task that cannot be satisfactorily addressed from just one disciplinary toolbox; (2) understanding the different disciplinary approaches that are needed to solve the problem, address the issue or complete this task; and (3) synthesising or integrating these approaches to produce a viable solution, reasonable judgement, or a product that creatively accommodates the different perspectives. A more detailed description of each step in the process follows.

Step 1: Identifying the issue

An interdisciplinary approach starts with a 'wicked problem' such as land use, climate change, water access or bushfires (see Rittel and Webber 1973, who first introduced this term). Wicked problems have a number of features that require an interdisciplinary approach. They are complex issues where multiple systems, perspectives and stakeholders are entangled. This means the problem itself is contested: there is disagreement about what the issue is; why the issue arose; what will be the consequences of inaction or of potential solutions; and thus disagreement about what should be done. There is high risk and low certainty in a wicked problem and so there are no easy solutions (see Chapter 13 on complexity for more on how to respond to high risk and low certainty issues). Yet they are also pressing problems that demand action. The term 'problem' is often used in this chapter, but it is used to refer to any complex and controversial subject-matter involved when shaping and reshaping the environment. In some contexts a 'problem' might be called an issue or question, in others a task, job or even a design brief.

Step 2: Identifying the disciplines important for addressing the issue

To solve a wicked problem, multiple approaches from multiple disciplines must be employed. Each discipline provides a different perspective or method that illuminates a different aspect of a complex wicked problem. In other words, when taking an interdisciplinary approach we identify the different 'intellectual work' needed to address our 'wicked' problem, and then identify the different tools available from different disciplines that can be used to do this type of work.

To employ multiple disciplines, we have to: 'interrogate' (Beilin and Bender 2011) and 'transcend' (Beilin and Bender 2010, p. 183) the usual disciplinary approaches; question the dominant approach or perspective on a problem; and challenge the idea that some ways of addressing an issue – for example, the scientific or economic – are more important, or have a higher priority. This interrogation opens up the space to consider new perspectives and see 'a different and richer picture' (Beilin and Bender, 2011, p. 159).

Gaspar (2010, p. 61) argues that an interdisciplinary approach does not require expertise in every discipline, but it does require being willing and able to interact, communicate and learn from diverse perspectives. An interdisciplinary approach requires the ability to identify the various areas of expertise needed and where to access people who can provide it.

Controversial question 12.2

- (a) In order to take an interdisciplinary approach, how much expertise in the different disciplines is needed?
- (b) Does taking an interdisciplinary approach require mastery of at least one discipline?

Step 3: Synthesising or integrating

The diverse approaches are integrated or synthesised to produce some sort of outcome or result – a product, solution, decision, policy, model, plan or some advice. Each of these is what Boix Mansilla and Duraising (2007, p. 219) call a 'cognitive advancement'. For example, an interdisciplinary approach might result in a policy paper that integrates what scientists say about the ecological impacts of forestry with what social scientists say about the public perceptions of the forestry industry, or in a commercial building that integrates social, aesthetic, environmental and economic concerns. The outcome might be knowledge development for its own sake, but equally it might be what Pohl calls 'practically relevant knowledge' (2005, p. 1161) and the action that results. If offering advice to a government body, then the interdisciplinary product is a document, but equally if a government body is deliberating on the basis of advice from various disciplines, then the outcome might be a decision and action (see Box 12.2 for more on the nature of an interdisciplinary approach).

Box 12.2

What is the difference between disciplinary, interdisciplinary, multidisciplinary and transdisciplinary approaches?

Although these terms are highly controversial and often used in different ways, the following is one useful way of distinguishing them:

- *Disciplinary*: a disciplinary approach employs a method from an established discipline to examine the standard subject matter of that discipline, for example historical analysis of ancient texts or architectural

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Box 12.2 continued

design of buildings. Disciplinary approaches can be combined in multiple ways. The three terms 'multidisciplinary', 'interdisciplinary' and 'transdisciplinary' seem to be the most common terms used to describe such combinations, though there are others.

- *Multidisciplinary*: multiple disciplines are employed, providing a smorgasbord of independent insights, or an intellectual division of labour, but without interaction or integration. An example is a historical analysis of forestry practices side-by-side with an analysis of their ecological impact, but without combining them to create a new coordinated perspective or changing the practices of those involved.
- *Interdisciplinary*: multiple disciplines interact and are integrated to create a new synthesis. For example, the ecological analysis is combined with the historical analysis to better understand possible beliefs and values about different approaches to forestry management. In some forms of interdisciplinary approach, the outcome is a synthesis of insights from multiple disciplines, but the disciplines remain unchanged; in other forms, the synthesis changes the disciplines. The negotiation between disciplines results in a changed perception of the issues and of possible solutions, as well as a change in the disciplinary tools available as new tools emerge from the integration of multiple disciplines. In this way, new hybrid disciplines, such as environmental economics, emerge.
- *Transdisciplinary*: disciplinary integration is involved, as well as integration with perspectives and approaches from outside the university – input, collaboration and participation from all stakeholders rather than just the academic disciplines (see Pohl 2011). For example, the historical and ecological analysis is integrated with the results of interviews of local people and forestry workers to give a broader perspective about the beliefs and values about different kinds of forestry management.

In this chapter, and in this book, we use 'interdisciplinary' to cover an interdisciplinary or transdisciplinary approach. See CERl (1972), Klein (1996), and Wickson, Carew and Russell (2006) for more detailed treatment of different kinds of disciplinarity and interdisciplinarity.

Question 12.2

- When is it best to be multidisciplinary? Interdisciplinary? Transdisciplinary?
- Imagine an idea like a zero carbon nation. What would be the differences between a multidisciplinary, interdisciplinary and transdisciplinary approach to this idea?

Controversial question 12.3

To what extent should outside stakeholders be involved in an interdisciplinary approach?

Scenario 12.2

A new desalination plant is proposed to solve a shortage of local and global fresh, clean water.

- Which disciplinary approaches would be relevant for deciding whether this is a good idea and, if so, for deciding where and how to build it? What would each approach provide? Why would the approach be essential for deciding whether there should be a desalination plant, and for creating the best design, placement and construction of the plant?
- How might the insights gained from the different approaches be integrated?

Scenario 12.3

Imagine evaluating the feasibility of a new residential development that is proposed for land previously zoned for commercial use.

- What disciplinary approaches would need to be considered? Think about, for example, sociology, ecology, philosophy, business and politics. What would need to be considered from each of the approaches?
- How might the considerations from all the approaches be balanced, synthesised or integrated?

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Why are multiple disciplines needed to address 'wicked' problems?

It might be thought that historians just do history, architects just do architecture, and zoologists just do zoology, and they never cross paths. Yet even specialists have to draw on other disciplines when faced with wicked problems. This is because wicked problems are not simply planning or architectural or zoological problems – the problems do not respect disciplinary boundaries (Gasper 2010, p. 61). As Brewer (1999, p. 328) puts it, 'The world has problems, but universities have departments'. Thus, one of the aims of an interdisciplinary approach is to break the traditional academic compartmentalisation. So, when dealing with 'wicked' problems, it is important to avoid automatically prioritising the perspective of an architect, engineer, urban planner or

ecologist, and instead examine how different perspectives might contribute to different ways forward, different solutions and innovations.

If only one discipline is employed to approach a wicked problem, the final outcome is likely to be inadequate, superficial or flawed. For example, an engineer might calculate the most efficient energy use for a new community centre; but if he or she does not also consider how people will interact with the centre, he or she will build something that is energy-efficient but does not fulfil people's needs or wants, and which is rarely used. Alternatively, a sociological analysis might indicate that rebuilding fire-destroyed towns is necessary for preserving rural communities, but these communities will be in imminent danger if they are rebuilt without also considering what planners and architects might say about mitigating fire risk. If we are managing a national park, but we neglect the engineering or architectural design perspective, we could lose the opportunity to have huts that are cheap, light and easy to construct, or sites with access to toilets, drinking water, and fabulous photo opportunities, which would attract more visitors and so raise more revenue to further support the park. In each of these cases a single disciplinary approach is not wrong, but it is limited or superficial, while an interdisciplinary approach is more sophisticated and nuanced.

There are two interrelated reasons why a single disciplinary approach is inadequate for decision-making, problem-solving and planning about 'wicked' environmental problems.

First, a single disciplinary approach will not allow us to *understand* the whole environmental issue which often presents over larger scales and encompasses multiple systems. For example, to understand the health issues in a particular rural community, a medical scientist would need input from entomology about common insects and how they might affect the health of the local people. In order to understand the design of school buildings, an architect would need input from educators and sustainable designers (as Dominique Hes shows in Chapter 6).

Scenario 12.4

Consider an environmental issue (e.g. migration due to the sea level rise in the Pacific) that could be investigated by a discipline like politics, psychology or urban planning. What other disciplinary approaches would be needed to understand this issue?

Second, to *implement* an environmental solution, plan or decision we have to deal with issues that are best tackled by a number of disciplines. For example, both medical and educational knowledge are required to implement a new healthcare policy or contraceptive method. In Ilahita, Papua New Guinea, in order to solve an engineering problem of where to locate and construct wells for the local people, the engineer Graham Moore first had to use an anthropological approach to help him understand

how the local people used water (see Chapter 5). Prior to construction, architects have to consult engineers, and engineers have to consult mathematicians. Even something as simple as constructing a bicycle path requires input from several disciplines: materials science about the composition of the pavement; ergonomics about the design of signs that are visible to cyclists; transport planning about the likely users; sociology about the potential impact on neighbouring landholders; surveying about land titles on the proposed path; stream ecology about proposed fords and bridges and their effects on the waterways; and even behavioural ecology about the risks of swooping magpies. The input from each of these disciplines needs to be combined in order to construct the bike path.

Scenario 12.5

Pick a product, outcome or design that might be developed by a discipline like engineering or tourism (e.g. a water purifier or a resort). What other disciplines would need to be consulted in order to successfully implement this product, outcome or design?

When should someone take an interdisciplinary approach and when a disciplinary approach?

Whether an interdisciplinary or a disciplinary approach is better depends on how the problem is framed. If the problem is framed narrowly – for example, an analysis on one or a limited scale, system or perspective – then a single disciplinary perspective will probably be appropriate. If the problem is framed in a broader or more complex manner – involving multiple or global scales, systems and perspectives – an interdisciplinary approach is more likely to be needed (see Chapter 11 on research methodology for more on framing problems in terms of disciplinary approaches).

For example, consider the issue of bushfire (see Chapter 8). The problem might be framed in a narrow way: 'How have successive generations viewed fire in the Australian landscape?' To address this problem, the discipline of history and the methods of historical analysis would be useful. The problem can, however, be framed more broadly: 'Given the threat of bushfire, how can we best live in and manage the Australian landscape?' To address this 'wicked' problem, an interdisciplinary approach which considers multiple disciplines and their interactions is needed; it will be useful to understand how the views of the landscape have changed historically, but the current ecological and economic impact of bushfire also needs to be considered.

Put in a different way, an interdisciplinary approach is needed to provide a broad perspective on a complex wicked problem: 'How might we develop the Antarctic in a

sustainable way?' However, a disciplinary approach is well suited to address problems or questions that provide a partial perspective on a 'wicked' problem: 'What sorts of substances might be durable enough to use in the construction of buildings for the Antarctic conditions?' For example, the problems around forestry practices might be framed in terms of the biophysical sciences: 'What are the ecological effects of different approaches to forestry management?' Yet, as the authors note in Chapter 3, this illuminates only one facet of the larger 'wicked problem': which approach to forestry management is best? Addressing this problem requires an interdisciplinary approach where the ecological consequences are synthesised with the social and environmental.

This does not mean that an interdisciplinary approach is always better than a disciplinary approach. Although necessary for addressing wicked problems, interdisciplinary approaches are 'demanding, complex and costly', so sometimes it is better if we specialise and address only one aspect of an interdisciplinary problem through a 'division of intellectual labour' (Gasper 2010, p. 56).

How are disciplinary perspectives integrated?

Integration is the key to an interdisciplinary approach – integrating multiple disciplinary perspectives to create a better understanding of the problem, better methods to approach the problem, a better analysis and a better solution. Yet 'integration' is a controversial process that is not precisely defined. The literature describes what is being integrated – for example, language, concepts, models, and products (Pohl et al. 2008, p. 415) – but there is very little written about how to integrate. So, even though integration is necessary for an interdisciplinary approach, there are no universal rules, and the process of integration can be decided only on a case-by-case basis (as argued by Wickson, Carew and Russell 2006, p. 1052). Nevertheless, the rest of this chapter will provide some guidance about how to integrate.

Controversial question 12.4

When engaged in environmental planning, decision-making and design, how can disciplinary approaches be integrated?

When trying to integrate, how can the confusion of conflicting perspectives be managed?

When addressing a 'wicked' problem, there will often seem to be a conflict between the perspectives offered by different disciplines. These problems are not like simple

equations where there is only one answer and you can double-check that you have this answer. Instead, because of the complexity, it is easy for these problems to appear confused or chaotic, with no way forward. Architects may design a building that occupies its site in a beautiful and innovative way, while zoologists point out that this building would have a negative impact on the local ecosystem. In Costa Rica, as geographer Blythe McLennan shows in Chapter 1, a rural development approach seems to be in conflict with the forest conservation advocated from an ecological approach. Each perspective seems legitimate, but we cannot hold both at once, so how can they be integrated? (See Wickson, Carew and Russell 2006 for more on this paradox of integration.)

Controversial question 12.5

When there are two conflicting, expert perspectives, does this mean that one is correct and the other is not? that they are both equally right? that they are both equally wrong? that one is better than another? (Reflect on the discussion of norms and values in Chapter 15.)

In the face of conflicting perspectives, here are two common (but mistaken) responses:

- 1 One perspective is right and the others are wrong or unimportant and so should be disregarded. We just need to find the right perspective.
- 2 All perspectives are equal, just different. It's all a matter of opinion in the end, so choose whatever you want. Engaging in further discussion or debate is pointless.

Taking either of these options – like taking a single disciplinary perspective – will frequently lead to superficial, poor decisions about wicked environmental problems.

Perhaps someone decides that one perspective is right and the others are wrong, and so ignores the 'wrong' perspectives. For instance, if he or she decides the architectural perspective from the earlier example is right, he or she would build something that is beautiful but devastating for the environment. This would be a poor decision because there is a better option, which would be to find some way to accommodate both perspectives – perhaps by modifying the design in light of ecological effects so that it is both an aesthetic design and safe for the local flora and fauna.

Perhaps someone decides that all perspectives are equally good, but this also means taking the preferred perspective and ignoring the other perspectives. In Costa Rica it might be decided that even though forest conservation and rural development are equally good, conservation is the preference and rural development is ignored. This would result in preserving the forests but leaving the local people in poverty because

they have no jobs and no way to make a living off the land now protected for conservation. This would also be a poor decision given there is the better option of creating a new solution where both perspectives can be honoured – perhaps by designing a way for the local people to make a living from sustainable use of the forests.

Because of the conflicting but legitimate perspectives involved, there are no absolutely right answers for environmental decision-making, planning and design around 'wicked' problems; but it is also not just a matter of opinion. This does not mean we have to give up on answers and solutions. Instead the aim of an interdisciplinary approach is to make the problem 'workable' (Beilin and Bender 2010, p. 185), and then to develop *better* answers and solutions.

Controversial question 12.6

- (a) How can a solution be reached when there are multiple conflicting perspectives, where none is 'right', nor are they all 'equally good'?
- (b) Here are some examples of conflicting perspectives or disagreements. How should they be resolved in order to create a better solution?
- The architect says it is the best design for the building and it should be built, while the ecologist says it will damage the local ecosystems and should not be built.
 - The mining corporation says its proposed mine will not harm the local community while the Indigenous community says it will.
 - The economist says that it is in our best interests to build a nuclear power plant, whereas the environmental scientist says that this is not in the interests of our children and their children.
 - Ada says the proposed land development will be good for her, while Mohammed says it will be bad for the community.
 - The economist says it will be good for short-term economic growth, but the climatologist says it will be bad for long-term, global pollution levels.

What role does creativity have in integrating diverse and conflicting perspectives?

An interdisciplinary approach requires creativity and imagination. Rather than judging the best disciplinary alternative, a better outcome is obtained by creatively synthesising or combining the multiple approaches to design a new alternative which satisfies what were otherwise conflicting perspectives. For example, when considering how to reduce pollution in the local environment there is an obvious clash between economic costs and health. To solve this, instead of choosing one over the other, it is better to

look at alternative regional or national policies and laws on pollution in order to have both economic *and* health benefits – incentives might be set for reducing pollution, or requiring that toxic waste be kept on the producer's property, which would mean that reducing pollution will now be in the best economic interests of the companies involved. As a result the companies would invest in pollution reduction, which would result in economic and health benefits (see O'Brien 2000, Chapter 1).

A similar means of creatively synthesising multiple approaches is by changing the scale being considered. For example, when thinking local and short-term, there might seem to be a conflict between creating a high standard of living and the interests of the ecosystem, because the available resources can be used only for one or the other. Yet when seen from a global and long-term perspective, what is good for the environment leads to the greatest long-term standard of living.

Ruth Beilin (see Chapter 4) gives another good example of creative integration. The management of farms is difficult if it is seen as a choice between agricultural productivity or ecological conservation in individual farms. But a better solution is to see the situation differently, where tree planting at the top of hills and along the waterways leads to both ecological improvement and increased productivity by improving the hydrological system, recharging the aquifer and reducing erosion, while providing shade for stock and habitat for native species. This might be described as a creative ecological approach to farm management.

Controversial question 12.7

- (a) Do all perspectives have equal value or weight?
- (b) Is it always possible to develop solutions that balance all the relevant disciplinary perspectives?
- (c) Can there be irreconcilable differences between different perspectives on a 'wicked' problem? If there were, how could an integrated perspective be created? Should there be a trade-off between perspectives?
- (d) Can benefits in one disciplinary area make up for harms in another area – for example, economic benefit at the expense of environmental costs? Is it ethical to have benefit now traded off against harm later?

How does someone judge that there is a better interdisciplinary solution?

Even though we cannot single out one solution to a 'wicked' problem as the firm, final, 'right' solution, this does not mean that all possibilities are equally good. The alternatives need to be critically evaluated (as discussed in Chapter 9) and a case made to justify why

one is better than the others. Another way of putting this is we have to make a reasoned judgement, based on criteria – we argue that one solution is more nuanced, sophisticated, illuminating or enriched than the alternatives. In particular, the better solution:

- is more fitting for the context;
- is more in harmony with a broad range of disciplinary perspectives and approaches without ignoring anything important;
- is more inclusive and takes into account a broader range of temporal and spatial scales, systems and perspectives;
- solves more of the current problems while leading to fewer new problems;
- has the most benefits and fewest costs;
- has the strongest reasons for it, and the weakest reasons against it (on the balance of evidence for and against); and
- is agreed to be the better solution after a process of deliberation, negotiation, and collaboration (Beilin and Bender 2011, p. 163, call this having 'inter-subjective agreement').

So, for example, it might be argued that the best alternative for managing forests in Costa Rica is to log the forests in a sustainable way. It cannot be proved that this is the right option, but it can be argued that it is the better option at this time and place – while recognising that over time, and at different scales of engagement, this may change. Because this alternative both conserves the forests and provides a livelihood for the local people, this is better than not allowing use of the forests while the people are in poverty, or giving the people a livelihood by destroying the forest through unsustainable logging.

Conclusion

How does someone engage in interdisciplinary thinking?

What does an interdisciplinary thinker do? In the context of environmental decision-making, management and design, an interdisciplinary thinker will accommodate the various approaches and perspectives to reach a creative, balanced and reasonable outcome by:

- acknowledging that several important disciplinary approaches are relevant to every complex environmental solution, decision or action;
- valuing and seeking input from multiple disciplinary approaches;
- negotiating how important each approach is for the issue at hand;
- evaluating the evidence or reasons supporting the insights and perspectives from each of the approaches, including the costs and benefits;
- prioritising the importance of each perspective for the context;

- generating multiple possible outcomes: answers, solutions, decisions or actions;
- balancing, weighing up or accommodating the pressures from the different approaches in order to create a reasonable outcome;
- negotiating with other stakeholders to judge which is the better outcome; and
- making a case for why this outcome is better than the alternatives.

Because this list is still fairly abstract, it may not be obvious what someone should do to engage in interdisciplinary thinking. What exactly does someone do if they are balancing, weighing up or accommodating different disciplinary approaches and perspectives?

Although it cannot be codified or turned into a set of rules, interdisciplinary thinking can be made more concrete by considering the questions interdisciplinary thinkers may address and answer (see Table 12.1). Addressing these questions in roughly this order is a useful model for an interdisciplinary approach to 'wicked' environmental problems.

Table 12.1 Interdisciplinary thinking.

Interdisciplinary thinking questions	Example from Chapter 6 – sustainable and effective learning
What is the problem? What aspect of the issue will I address? Who is affected? Who are the stakeholders? How will I bound, frame or scope the issue? How do I define the systems involved? How could the boundaries be altered to be more inclusive and provide scope for re-imagining the problem? Would a change in scale provide a different view? Would it be helpful to reframe the problem question?	What is the problem? How can I create sustainable school buildings that enable effective learning?
How are the different disciplinary approaches involved? What disciplines provide relevant insights and what do they contribute? Have I ignored important perspectives or approaches in framing this issue? Can I frame the issue in a way that is more inclusive of all perspectives and approaches?	How are the different disciplinary approaches involved? What materials can I use and how can I use them to design and construct a school building (engineering, architecture) that balances educational needs (education) with the need for sustainability (environmental science), within the financial constraints (finance)?
What do I want to achieve? For example, a solution, product, design, decision, action ... What are the needs? What is the brief?	What do I want to achieve? School buildings that are both sustainable and effective learning environments.
What criteria will I use to judge success? Do the criteria reflect all the important approaches and perspectives, rather than including, for example, only financial or technical feasibility?	What criteria will I use to judge success? Students are able to learn in and from the building. Good air quality, light, acoustic performance, space and thermal comfort enable effective learning. Heating is within the comfortable range all year round, while the building is still energy neutral.

Table 12.1 (cont.)

Interdisciplinary thinking questions	Example from Chapter 6 – sustainable and effective learning
What possible alternatives are there? Possible solutions, products, designs, decisions, actions ...	What possible alternatives are there? There is a range of alternatives based on choice of materials and energy use: different orientations for the building, window placement, thermal mass, insulation and configuration of internal spaces.
What are the costs and benefits in relation to the different disciplines? How can I accommodate the various costs and benefits from the different approaches? How can I creatively reframe the problem or create new alternatives to better satisfy the perspectives and approaches?	What are the costs and benefits in relation to the different disciplines? Some of the costs and benefits: doors can allow ventilation but lead to poor acoustic performance; allowing extra light can improve learning but make the building too hot; and open spaces can allow for flexible learning but result in decreased acoustic performance.
What alternative best meets the criteria for success? Why is this better than the alternatives?	What alternative best meets the criteria for success? Straw-bale building explicitly designed to provide a comfortable and effective learning environment. Unlike traditional designs this accommodates the needs of learning and sustainability.
How can I implement the solution, product, decision or judgement? How do I accomplish what I want to achieve? What do I want to do and how do I do it?	How can I implement the solution, product, decision or judgement? Involve students in the building process, and use the building as a 'textbook' for students to understand sustainable design.

Summary

The main aim of this chapter was to equip readers with the tools they need to deal with wicked environmental problems – to make these complex problems 'workable' by taking an interdisciplinary approach to the practice of researching, planning, designing and managing environments. Interdisciplinary tools can transform 'wicked' problems from confusing and paralysing traps to puzzles that can be untangled.

Review questions

- 1 What is an interdisciplinary approach?
- 2 How is an interdisciplinary approach to environmental planning, design and management different from a standard disciplinary approach to research?
- 3 How is an interdisciplinary approach an important tool for addressing wicked environmental problems?
- 4 Why should we go beyond the normal boundaries of individual disciplines when dealing with environmental issues such as natural resource management, bushfires, drought or urban development?
- 5 When should an interdisciplinary approach be taken and when should a disciplinary approach be taken?
- 6 When taking an interdisciplinary approach, how can conflicting perspectives be dealt with?
- 7 What is the role of creative integration in an interdisciplinary approach?
- 8 What criteria can be used to negotiate the better solution to a wicked problem?

Further reading

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Part 3

Theory