



Sustainability in the Australian Curriculum: Geography

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Abstract

Sustainability is one of the seven major concepts in the geography curriculum. It is also one of the three cross-curriculum priorities in the Australian curriculum, together with Asia and Australia's engagement with Asia, and Aboriginal and Torres Strait Islander histories and cultures. This paper describes how the concept is explained in the curriculum, explores some of the implications for the teaching of physical geography, discusses the contestability of the concept, and outlines where and how sustainability appears in the curriculum for each year.¹

Sustainability is a noun formed from the adjective *sustainable*, which means being able to be maintained or kept going – something is sustainable if it can be continued into the future (Sutton, 2004). The concept can be applied in many contexts, such as the sustainability of places, but the curriculum is mainly concerned with environmental sustainability. Some definitions extend the concept to include social, economic, political and cultural sustainability, but I think this confuses the meaning of the term. Many of these forms of sustainability are not about sustaining something into the future, but about some other desirable outcome – such as political democracy, respect for diversity, or a strong economy. Sustainability also should not be confused with sustainable development, as it often is in textbooks for students and guides for teachers, because the terms *sustainability* and *sustainable development* are very different concepts. Sustainability is the state or condition of being sustainable; while sustainable development is a process of economic and social change designed to produce an environmentally sustainable economy and a just society (Porritt, 2005, p. 21).

The first step in applying the concept of sustainability to the environment is to decide what should be maintained into the future. In the description of the concept in the Australian Curriculum: Geography, sustainability is defined in this way (ACARA, 2014a):

The concept of sustainability is about the capacity of the environment to continue to support our lives and the lives of other living creatures into the future.

Two comments can be made about this statement. The first is that elsewhere in the curriculum *human welfare* is added to “our lives” to make the point that sustainability is about more than ensuring our survival; it is also about the quality of our lives. The second is that the inclusion of “and the lives of other living creatures” in the definition is a good topic for class discussion, with two questions that could be debated: whether this is an impossible objective, given the current rate of species extinction, and whether human sustainability should take precedence over the sustainability of other living creatures if there is a conflict.

In an elaboration in Year 10, and in the glossary to the curriculum (ACARA, 2014b), the capacity of the environment to support human life and welfare is divided into four environmental functions, or the four S's:

1. The Earth's *source* function – the production of the food and materials on which we depend from the natural resources of soil, water, forests, minerals and marine life;
2. The Earth's *sink* function – the safe absorption (through breakdown, recycling or storage) of the wastes and pollution produced by production and human life;
3. The Earth's *service* function – the provision of the environmental services that support life without requiring human action, such as climatic stability, biodiversity, ecosystem integrity, pollination, and protection from ultraviolet radiation;
4. The Earth's *spiritual* function – the recreational, psychological, aesthetic and spiritual value of environments to humans.

Standard descriptions of these functions, which come from economics,² group the third and the fourth together as the Earth's service function. However, there is a major difference between the life support functions of the environment and what the curriculum calls the Earth's spiritual functions. The service functions exist independently of human thought, can be studied scientifically, and are the same for all people. For example, the ozone layer was not discovered until 1913, yet it had been protecting humans from ultraviolet radiation for tens of thousands of years. The spiritual functions only exist because

of human thought, which varies from person to person, culture to culture, and over time, and are about relationships with the environment that involve our emotions, imaginations and beliefs. These include, but go beyond, the religious and supernatural aspects of the environment, and range from the feelings produced by a beautiful or dramatic landscape to beliefs in sacred sites or the spiritually purifying power of water. They remind us that the environment is much more than an economic resource to be exploited, and that it sustains human life in more than utilitarian ways.

The value of this classification of environmental functions is that for each function we can identify principles or rules that describe what sustainability means for that function, and these principles give students a set of criteria for assessing sustainability in different situations.

Principles 1 and 2 are about the source function of the environment. The sustainable use of these resources can be defined as use that maintains the capacity of the environment to continue to produce the resource into the future.

Principle 1

To be sustainable, renewable resources should be extracted at or below their rates of renewal, and in ways that do not reduce the productive capacity of the environment.

Examples of the application of this principle are:

- A water resource, such as a river or groundwater, can be used sustainably provided that water is not extracted faster than it is being replenished by rainfall or groundwater inflow. Otherwise the river and the dams it feeds runs dry, or the water table drops. The fate of the Aral Sea is an extreme example of over-extraction, but there are growing problems resulting from excessive groundwater extraction in the High Plains of the USA and the North China Plain, and from surface water extraction from the Colorado River in the USA and the Murray-Darling river system in Australia.
- A fish stock is classified as sustainable in Australia if the level of harvesting does not pose a risk to the natural regrowth of the stock, and the size of the stock is big enough to ensure natural regrowth. This can be simplified to saying that sustainability means not catching fish faster than they can reproduce. If fish are caught faster than this, the fish stock will eventually fall to a size where it cannot revive, as happened to the cod fishery off the coast of Canada in the 1990s (Sale, 2012). Almost all the fish stocks in Australia, for which sufficient data are

available, have been classified as sustainable, which may be a surprise to many people but reflects the high level of fisheries management in this country. This involves careful monitoring of fish stocks, control of the quantity of fish that can be caught, regulation of fishing methods, and the designation of marine reserves from which fishing is excluded and in which fish stocks can grow.

- For timber resources the idea is the same – sustainable use means not cutting down trees faster than the forest can grow new wood.
- Agricultural production is sustainable provided that the plant nutrients, extracted from the soil when crops are harvested, are replaced.

The second half of this principle – in ways that do not reduce the productive capacity of the environment – is about preventing damage to the marine ecosystems in which fish breed; the degradation of agricultural land through soil erosion, compaction, salinisation and acidification; and the pollution of water resources.

The sustainability of a renewable resource can be measured, although not always precisely, by indicators such as the quantity of fish or timber, the depth of water tables, the rate of soil erosion, or the area of land lost to salinisation.

Principle 2

To be sustainable, non-renewable resources should not be extracted faster than the rate at which they can be maintained through the discovery of new reserves, recycling or substitution, or in ways that damage other environmental functions.

This is similar to Principle 1 in that it is designed to ensure the continuing availability of resources, but with non-renewable resources there are opportunities to replace a declining resource with a substitute material that can perform the same function. In addition, while Principle 1 requires government or community action to ensure sustainability, it could be argued that the first part of Principle 2 does not. This is because in cases when a non-renewable resource begins to become scarce its price rises, and more effort is made by companies to locate new reserves, recycle the material, and/or develop substitutes.

The second part of this principle – which refers to issues ranging from the global increase in greenhouse gas emissions to the effects of mining on local environments – is a clearer case of government regulation being needed to ensure sustainability. It also illustrates the way in which the principles are interrelated, in that the sustainability of one function, such as the supply of energy for industry, should not be at the cost of

the sustainability of another, such as the quality of underground water for agriculture.

Principles 3 and 4 are concerned with the sink function of the environment.

Principle 3

Biodegradable wastes should not be added to the environment in ways that prevent them from being broken down and safely recycled or stored, or reduce the productive capacity of the environment, or threaten human health.

Principle 3 is about the ability of microorganisms to break down biodegradable materials and either store the resulting elements, or make them available for plant growth. However, heavy discharges of organic matter from agricultural land, sewage plants or agro-processing factories can promote the growth of algae in inland and coastal waters. This toxic algae is harmful for people and animals and, because it consumes oxygen, the algae also makes the environment uninhabitable for aquatic life. If this principle is not followed, a water resource may become less productive or even unusable because of eutrophication, and consequently less able to support human welfare.

Principle 4

Non-biodegradable wastes should not be added to the environment at levels that threaten human health or other environmental functions.

Principle 4 is about wastes that environmental processes are unable to make safe. If this principle is not followed, the source function of the environment could be threatened by toxic chemicals that make land or water resources unusable, or kill marine and aquatic life. Human health could also be threatened. This principle is the subject of a growing body of environmental regulation which bans or limits the discharge of toxic substances into the environment, with the aim of keeping their concentrations below the levels that affect the health of humans and other living bodies.

The sustainability of waste disposal can be measured by a range of indicators, including the levels of nitrates in rivers and groundwater, pesticides in the environment, oxygen in aquatic environments, pollutants in the atmosphere, and heavy metals in soils.

Principles 5 and 6 concern the protection of the service and spiritual functions of the environment, respectively.

Principle 5

The life support and ecosystem services functions of the environment should be protected.

Ecosystem services are the free environmental services that support life without requiring human action. They include purification of air and water, regulation of hydrological flows, retention and storage of water, renewal of soil, pollination of plants, control of agricultural pests, dispersal of seeds, cycling of nutrients, provision of genetic resources, protection from ultraviolet radiation, stabilisation of climate, and moderation of temperature extremes (adapted from Costanza et al., 1997; Daily, 1997). They are frequently overlooked and taken for granted but are of crucial importance in maintaining human life and human welfare, and are of considerable economic value.

The sustainability of some of these services can be measured by indicators such as changes in the ozone layer, in local and global climates or in bee numbers.

Principle 6

The recreational, psychological, aesthetic and spiritual value of environments for people should be protected.

This principle is important because it enables teachers to explore students' enjoyment of environments, appreciation of their beauty, and feelings of wonder and awe. This is the affective side of geography, and can help to get students emotionally as well as intellectually engaged with the subject. It also provides a place to examine Aboriginal and Torres Strait Islander conceptions of the natural world and their relationships with Country and Place⁹. This principle takes the evaluation of environmental functions beyond those that directly support human life and welfare into more subjective and contentious ones. These cannot be measured objectively because they relate to human perceptions, feelings, beliefs, values and worldviews, but are often central to arguments about environmental protection and conservation.

Physical geography and sustainability

Teaching an understanding of sustainability may require some rethinking of the content of physical geography in schools, as Principles 1 to 5 all require a knowledge of environmental processes. Some examples are provided here.

1. To understand sustainability issues for water, students need some knowledge of the water cycle, and of the effects of precipitation, runoff and evapotranspiration on soil moisture and surface water.
2. To appreciate the role of vegetation in the environment, students need to know something about soil erosion,

evapotranspiration, microclimates and groundwater hydrology.

3. To understand sustainability issues for soils, students should know something about rates of soil formation and erosion⁵; the effects of cultivation on soil structure, plant nutrients and organic matter; and the causes of soil salinity and acidification. These are much more relevant to an understanding of sustainability (and of food and fibre production) than the common study of soil types, and more interesting for students. There is very little on these topics in the science curriculum.
4. To understand the sustainability of biodegradable wastes, students need some knowledge of the processes that break down and recycle or store these wastes, and of the causes of eutrophication (also not in science).
5. To understand some of the problems with the disposal of non-biodegradable wastes, students need some knowledge of the movement of groundwater.
6. To appreciate the importance of ecosystem services, students need to know a little about how these services work.
7. To identify ways of protecting valued landscapes, students need some knowledge of the processes, like soil erosion, that degrade them.

These are just a few examples, but they suggest a way of orienting the teaching of physical geography to an understanding of a range of practical and contemporary issues. This would be in keeping with the advice of Atherton (2009) to teach a physical geography that is about how natural processes relate to human activity, as a way of engaging students in topics they don't always find interesting.

Contestability

The six principles, and the concept of sustainability on which they are based, provide students with ways of assessing sustainability for each of the four environmental functions. In some cases, this assessment may be relatively straightforward, although not necessarily easy. For example, there are established methods for assessing the sustainability of renewable resources or safe levels of toxic waste discharge. In other cases, assessment is more difficult, because it involves complex situations and subjective judgements. Sustainability can be a highly contested concept, and the curriculum explores some of this contestability. For example, it has a number of statements about differences of opinion over sustainability and ways of achieving it. One is in the description of the concept, which includes these words (ACARA, 2014a):

There is a variety of contested views on how progress towards sustainability should be achieved and these are often informed by worldviews such as stewardship.

The contested views can take two forms.

1. For all of the four functions of the environment there can be disagreement over whether a situation is serious enough to require action. Some may even deny that a problem exists, despite the scientific evidence. This attitude is often based on a dislike of government regulation of business, and a belief that economic and social considerations, like the generation of income and employment, should have precedence over environmental sustainability. Others may use evidence of a problem to advocate greater regulation, or changes in our economy and ways of living, because of their dislike of capitalism and consumerism. Conservative comments that sustainability is *socialism masquerading as environmentalism* are descriptions of this view, and are sometimes correct.
2. There are also different views on how to achieve sustainability. For example, to ensure the sustainability of a renewable resource some people prefer methods that reduce the use of the resource, like restrictions on fishing, or bans on water use, or recycling paper and cardboard to reduce the need to harvest new wood. Others want methods that increase the output of the resource, like planting trees, improving soil fertility, damming rivers, farming fish (aquaculture) or making fresh water by desalination.

People's views on sustainability reflect their environmental ideology or worldview, even though they may be quite unaware of what this is. These views range from an ecocentric (environment-centred) view that humans are a part of nature and must manage the environment for the welfare of all life forms, to an anthropocentric (human-centred) view that humans are separate from nature and that the environment is there to provide for human needs (Gagnon Thompson & Barton, 1994). The latter view tends to see technology as the solution to sustainability problems, while the former advocates working with nature and changes in people's ways of living. In the glossary to the Australian Curriculum: Geography (ACARA 2014b), these are described as environmental worldviews.

The quote at the beginning of this section from the description of the concept of sustainability in the Australian Curriculum: Geography identifies stewardship as a worldview, but it is a type of anthropocentrism. Stewardship is explained

in the glossary to the curriculum as an ethical position that supports the careful management of environmental resources for the benefit of present and future generations. The term comes from the role of stewards, who did not own resources but only managed them for the benefit of others. The concept is similar to the well known statement that “We do not inherit the earth from our ancestors; we borrow it from our children”. This is an idea that might appeal to students (who are the children) and is a nice way of expressing the ethical aspect of sustainability. What might also appeal to them is that the origin of the saying is attributed to an Australian Minister for the Environment and Conservation, Dr Moss Cass, in 1974.⁴

Worldviews are particularly significant in disagreements over Principle 6, because this principle requires subjective judgements. As a result, there are considerable differences of opinion over which environments should be protected for their recreational, psychological, aesthetic or spiritual values, and what activities if any should be allowed in them. An example is opinions on the protection of Aboriginal sacred sites, which are places of spiritual significance that are important to some people but not to others.

This description of the way that sustainability is presented in the geography curriculum can be used to defend it against attacks that it is a left wing ideology, or in the words of one critic, a *hippie heresy* from the 1960s that is opposed to development and progress (Cater, 2014). For example, Principles 1, 3 and 4, and the second part of Principle 2, are explicitly or implicitly followed by government agencies in the management of environmental resources and wastes, and are based on science rather than ideology. Second, the curriculum recognises that there are different views on what priority should be given to sustainability, and on how to achieve it, and that these views range from left to right across the political spectrum. No one view is advocated, and the curriculum requires students to explore and debate different opinions. Third, the concept of sustainability in the geography curriculum is not one that is opposed to development. Sustainability is not about preventing environmental change, but about maintaining the environmental functions that support human life and human welfare. Humans have a long history of transforming their environments in ways that have enabled the world to support more people at higher levels of welfare. If humans had remained hunter-gatherers and not cleared land for farming, the world might support about only 100 million people, and would not have developed urban civilisations. If modern agricultural technologies had not been developed

the world might support only about three billion people, instead of the present around seven billion. Our way of life has been made possible by changes to the environment. Sustainability is about ensuring that these changes do not threaten important environmental functions, through actions like carefully managing renewable resources, preventing soil degradation, restricting climate change, and preserving genetic resources.

The contestability of some aspects of sustainability gives students the opportunity to explore topics and issues for which there are no simple answers, and where they have to evaluate conflicting opinions and sometimes conflicting evidence. They can debate some big issues, and learn to look critically at claims made by protagonists on both sides of an environmental argument. This is an important preparation for citizenship.

Sustainability Year by Year⁶

This section of the paper describes and briefly comments on how sustainability is incorporated into the F-10 curriculum. In primary school, it is not introduced as a concept until Year 4. Before then, Year 1 students examine how to care for places and their features, some of which will be natural, and explore the influence of people's feelings and perceptions on their views about the protection of places, including their environments, in Year 3. This should get them thinking about attitudes towards the environment. In some years where sustainability is not explicitly mentioned, I have included content descriptions that are about environmental change, because these changes can be evaluated for their implications for sustainability.

Year 4

The theme of Year 4 is *The Earth's environment sustains all life*, and the description of the year in the curriculum document highlights sustainability. It also describes the environment as having functions that support our lives. However, none of the content descriptions includes a study of the meaning of sustainability or of the four functions, yet without some discussion of these students will have difficulty in making sense of the year.

Content descriptions relating to sustainability in Year 4 are:

The importance of environments to animals and people, and different views on how they can be protected

The custodial responsibility Aboriginal and Torres Strait Islander Peoples have for Country/Place, and how this influences their

past and present views about the use of resources

The natural resources provided by the environment, and different views on how they could be used sustainably

The sustainable management of waste from production and consumption

The first content description is a bit problematic. The wording is about protection rather than sustainability, and they are not the same. I suggest interpreting it as protecting the importance of the environment to animals and people, which is about sustaining the functions of the environment. Sustaining these functions may require preserving environments from change, as in the conservation of biodiversity, but may also involve changes to the environment, as in farming for food production and the planting of forests for timber production. This content description also has an elaboration that reads:

explaining that people's connections with their environment can also be aesthetic, emotional and spiritual

The *also* refers to the first three functions of the environment, but mention of these vanished in the final stages of curriculum preparation. The elaboration doesn't make much sense without them.

The second content description also doesn't mention sustainability, but it provides the opportunity to study the ways that the concept of custodial responsibility for Country or Place underpins Aboriginal and Torres Strait Island land and resource management practices that promote sustainability. Teachers could explore with students the differences between Aboriginal and non-Aboriginal environmental worldviews. In an Aboriginal view, people are not separate from nature but embedded in it, and their responsibility is to keep it healthy. In non-Aboriginal or Western views, people are mostly seen as separate from nature and in control of it, and their responsibility is to develop it. These two viewpoints, one largely ecocentric and one largely anthropocentric, are likely to differ in the priority they give to environmental sustainability.

The third and fourth content descriptions are explicitly about sustainability, but to examine them students must have a definition of sustainability to use to decide if natural resources or wastes are being managed sustainably. Principles 1, 3 and 4 can be applied here, but

the general idea of environmental sustainability needs to be understood first.

Year 5

The content description relating to sustainability in Year 5 is:

The influence of people, including Aboriginal and Torres Strait Islander Peoples, on the environmental characteristics of Australian places

This relates to sustainability because some of the environmental changes that might be identified, like soil erosion or salinity, are ones that threaten the sustainability of an environmental function. Teachers could follow up issues discussed in Year 4 by using the sustainability principles to evaluate the consequences of environmental change, and compare the influence of Aboriginal and non-Aboriginal environmental worldviews on the impact of people on the Australian environment.

Year 7

One content description relating to sustainability in Year 7 is in the topic on *Water in the world*:

The nature of water scarcity and ways of overcoming it, including studies drawn from Australia and West Asia and/or North Africa

This implicitly involves sustainability, as managing water scarcity involves finding ways to use water sustainably. Note that in this elaboration of the first content description:

investigating the causes of water scarcity, for example, an absolute shortage of water (physical), inadequate development of water resources (economic), or the ways water is used sustainably

The third cause of water scarcity is misleading. If water is being used sustainably and is still scarce it would be a case of either the first or second type of scarcity. The original wording was "the ways water is used", which was about scarcity produced by extravagant uses of water, such as my watered garden, my neighbour's swimming pool, and golf courses in dry tourist resorts. The addition of *sustainably* has destroyed this meaning.

The second content description relating to sustainability in Year 7 is in the topic on *Place and liveability*:

The strategies used to enhance the liveability of places, especially for young people, including examples from Australia and Europe

which has an elaboration on:

discussing the impact of housing density on the liveability of places, examining whether liveability and environmental sustainability can be enhanced at the same time

The idea behind this statement is that if students decide that low density suburbs have the best liveability they could then be challenged to look at the environmental sustainability of that form of urban living, because low density suburbs remove agricultural land from food production, and use more water and energy in transportation than higher density suburbs. On the other hand, if they advocate higher density areas they could add environmental arguments to their case for higher density. In the first case, liveability and sustainability could be in conflict, while in the second they are not.

Year 8

Content descriptions relating to sustainability in Year 8 are:

The aesthetic, cultural and spiritual value of landscapes and landforms for people, including Aboriginal and Torres Strait Islander Peoples

The ways of protecting significant landscapes

The first content description is an illustration of the fourth function of the environment. The ideas in it can be applied to the second content description, as the first elaboration to this content description suggests examining how people's views on the aesthetic, cultural and spiritual value of landscapes and landforms influence their attitudes to the application of Principle 6.

Year 9

The content description relating to sustainability in Year 9 is:

The capacity of the world's environments to sustainably feed the projected future population to achieve food security for Australia and the world

This is a big topic. It is about the source function of the environment and asks students to assess the capacity of the world to produce enough food for the projected future population, while achieving both sustainability and food security for Australia and the world. These are complex questions, and there is no agreement on the answers. Teachers could perhaps predominantly focus on either sustainability or food security. A focus on sustainability would examine the potential to increase food output either by

intensifying production on existing agricultural land (intensification) or by cultivating more land (extensification), and the different sustainability issues associated with each method. The investigation could be confined to Australia, and the potential to increase food production in this country, and include a study of the environmental limitations to agricultural production in Australia, and the agricultural potential of the north. Principle 1 is relevant here. A focus on food security would explore the argument that increased food production won't achieve food security unless the reasons why people lack food, such as poverty, conflict, the conversion of land from food production to export agriculture, and government mismanagement, are addressed.

Year 10

The unit on *Environmental change and management* in Year 10 has a strong focus on sustainability. The relevant content descriptions are:

The human-induced environmental changes that challenge sustainability

The environmental worldviews of people and their implications for environmental management

The Aboriginal and Torres Strait Islander Peoples' approaches to custodial responsibility and environmental management in different regions of Australia

The application of environmental, economic and social criteria in evaluating management responses to the change

These provide scope for a study of several aspects of sustainability, ranging from the environmental processes (and their causes) that may be threatening the sustainability of an environmental function, to the influence of worldviews and economic and social considerations on decisions about environmental management. Note that the third content description is an example of the second, and the two could be studied together. I also think that the wording of the last content description is wrong, as what is being studied is not how to evaluate management responses but how to explain why these responses were chosen, as is apparent from the elaborations. This content description can be used to illustrate the contestability of decisions about sustainability.

The various aspects of sustainability included in Australian Curriculum: Geography and described above constitute a much more extensive study of the concept than in any other subject in the Australian curriculum, including science. In no

other subject will students learn what the concept means, how to apply it, and why it is contested. This gives geography an important role in the education of young Australians.

Conclusion

Sustainability is an important concept in the Australian geography curriculum. In teaching, it can be an integrating idea, because to understand the causes of unsustainability requires an exploration of both environmental and human factors, and to develop acceptable programs to improve sustainability requires a balancing of environmental, economic and social considerations. It provides a way of demonstrating the relevance of physical geography and the study of physical processes to our lives. In the classroom, it can be used to generate questions, identify problems, inform decisions and evaluate programs. Learning about sustainability also teaches students a way of thinking about some important local, national and global environmental issues, and the opportunity to examine some significant controversies, that they will not gain from other subjects. It is a concept that offers much to both teachers and students.

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Further reading

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Endnotes

1. The article is an adaptation of one published in *Geography* (Maude, 2014a), with an emphasis on how sustainability is expressed in the Australian Curriculum: Geography for Years F to 10.
2. For example, Ekins (2000) and Jacobs (1991).
3. Place is the Torres Strait Islander term for Country.
4. See <http://quoteinvestigator.com/2013/01/22/borrow-earth/>

5. The rate at which new soil is produced by the weathering of rock is very slow in Australia, because of the low rainfall, and is estimated to average about 1 millimetre per 1000 years. On the other hand the current rates of soil loss by water erosion across much of Australia are reported to “exceed soil formation rates by a factor of at least several hundred and, in some areas, several thousand. As a result, the expected half-life of soils (the time for half the soil to be eroded) in some upland areas used for agriculture ranges from less than a century to several hundred years” (State of the Environment 2011 Committee, p. 294). By the definition of sustainability in this paper this is not sustainable.
6. For a more detailed discussion of sustainability in Years 4 and 5 see Maude (2014b).