



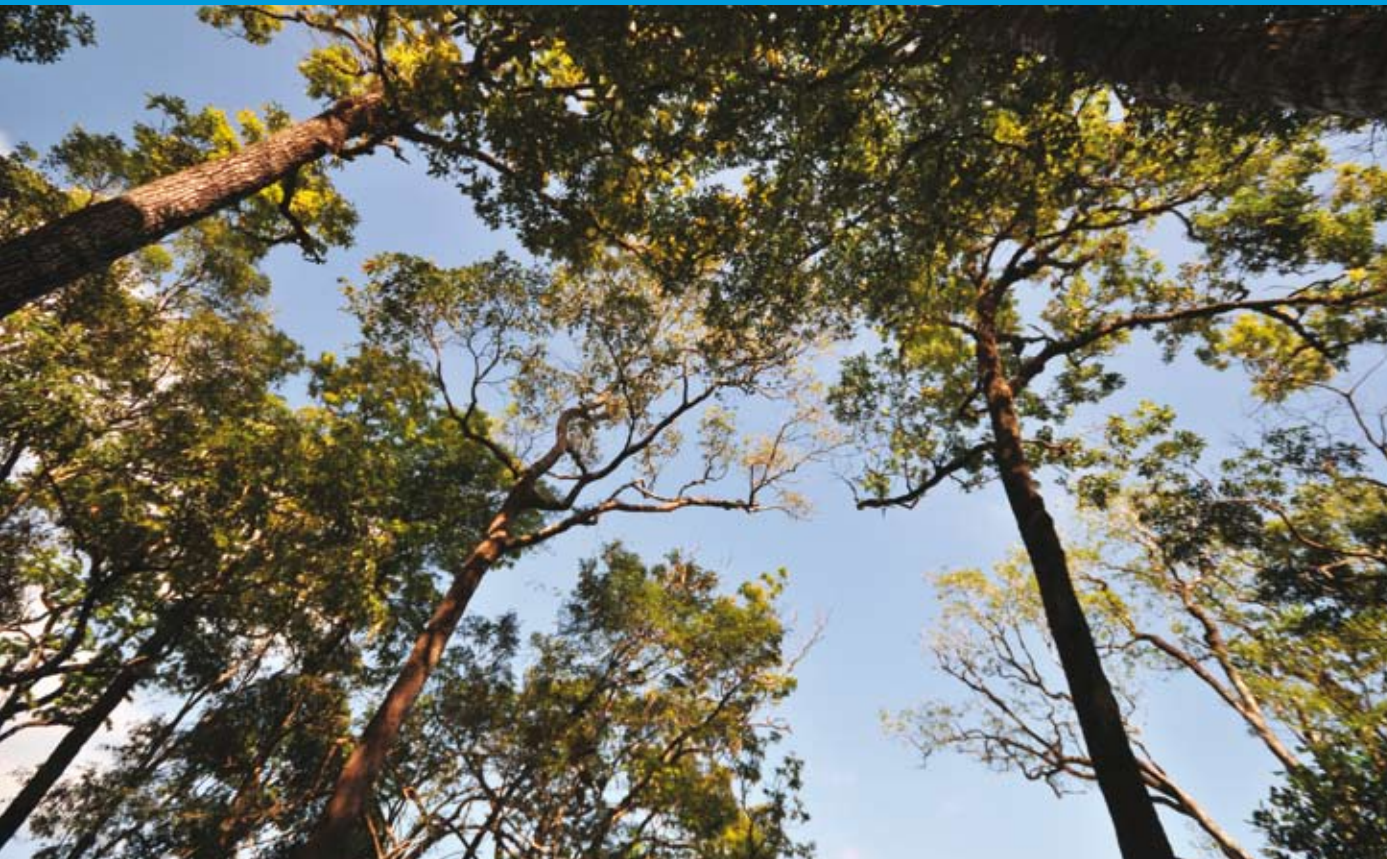
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# Reorienting Teacher Education to Address Sustainable Development: Guidelines and Tools

## Environmental Protection



**Reorienting Teacher Education to Address  
Sustainable Development:  
Guidelines and Tools**

# **Environmental Protection**

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# Contents

Preface . . . . .	iv
Introduction . . . . .	1
What is the Environment? . . . . .	1
What are the Causes and Consequences of Environmental Problems?. . . . .	2
How Can We Solve the World’s Environmental Problems?. . . . .	2
What is the Role of Education in Helping to Solve Environmental Problems? . . . .	4
Ecological Literacy. . . . .	4
Ecological Literacy and Systems Thinking. . . . .	5
Environmental Protection: Where to Start? . . . . .	6
How Can Your Students Help Solve the Problems, Both Now and in the Future? . . .	7
<b>Tools and Guidelines for Curriculum Integration . . . . .</b>	<b>8</b>
About the Tools and Guidelines . . . . .	8
The Compass: A Symbol of Direction and Sustainability . . . . .	8
Guidelines: Steps for Incorporating Environmental Protection into Science and Social Studies Curricula . . . . .	9
Get Ready: Identify Learning Goals and Central Issue. . . . .	10
<b>Curriculum Integration Worksheets. . . . .</b>	<b>16</b>
<b>Annex 1: Global Environmental Issues . . . . .</b>	<b>28</b>
<b>Annex 2: Eleven Basic Ecological Concepts . . . . .</b>	<b>37</b>
<b>Annex 3: Designing Lesson Questions . . . . .</b>	<b>38</b>
<b>Annex 4: Project Planning Form . . . . .</b>	<b>40</b>
<b>Annex 5: Bibliography and Resources . . . . .</b>	<b>45</b>

## Preface

In March 2005, the United Nations declared 2005 to 2014 as the United Nations Decade of Education for Sustainable Development (ESD), and UNESCO has been tasked to lead the Decade.

To contribute to this initiative, the Asia-Pacific Programme of Educational Innovation for Development (APEID) in UNESCO Asia and Pacific Regional Bureau for Education in Bangkok, Thailand, has organized several meetings to identify and conceptualize key content areas for ESD, and to recommend guidelines for reorienting existing education programmes in these areas, under the Mobile Training Team project with the support of the Japanese Funds-in-Trust.

A key outcome of the meetings is the establishment of the Asia-Pacific Regional Network of Teacher Education Institutes for ESD (ESD-Net) to coordinate efforts to incorporate ESD concepts, principles and values into their pre-service teacher education curricula, and to develop relevant teaching and learning materials. Based on requests from Member States in the Asia-Pacific region, some thematic issues were identified as priority areas, including climate change, natural disaster preparedness, environmental protection, human and food security, HIV/AIDS prevention, gender sensitizing, peace education and inter-cultural understanding.

Subsequently, regional and national-level capacity building workshops were conducted to share good practices and lessons learned in incorporating these ESD-related themes into two specific school subjects – science and social studies. More importantly, the workshop participants found the materials, pedagogies and processes developed and used in the training workshops to be valuable, relevant and practical.

Representing the collective effort of facilitators, deans and directors of teacher education institutions, teacher educators and teachers, these teaching and learning materials are now available in this series of publications, *Reorienting Teacher Education to Address Sustainable Development: Guidelines and Tools*. We hope that they will be a useful reference for educators and teachers seeking to instil and inculcate sustainable development concepts, principles and values into the minds of their students.



Gwang-Jo Kim

Director  
UNESCO Bangkok

## Introduction

If the environment is “everything that surrounds us”, then its imminent collapse should be a reason for serious alarm among all members of our species. As is often said in sustainability circles, when the environment collapses, everything collapses. There are many historical cases for us to choose and learn from: Easter Island in the Pacific, the Maya civilization in the Yucatan, the Khmer empire in what is now Cambodia. However, as we lament this quickening destruction of our planet’s environment and ecosystems, the majority of humankind continues to contribute to its continued degradation and destruction as if this were just hearsay.

This attitude begs the question, why?, as well as the more important question: what can be done to shift this complacent mindset to one which holds the environment dear and protects this thing that gives us almost everything we need for life? The truth is that many things on which your future health and prosperity depend are in dire jeopardy: climate stability, the resilience and productivity of natural systems, the beauty of the natural world, and biological diversity.

The most common and most practical answer to the seeming paradox is to raise awareness and increase our knowledge about the environment and its problems, and then we will protect it. Unfortunately, we have been doing this for over four decades through environmental education, and we are still accelerating faster and faster towards the abyss. What is the problem? The problem is one of education.

It is worth noting that this situation we find ourselves in is not the work of ignorant people. It is, rather, largely the result of work by people with B.A., B.S., L.L.B., M.B.A., and Ph.D. degrees. The problem lies in the way our education has prepared us to think about the natural world. Instead, one could say that all education is environmental education. By this I mean that what is included or excluded in our curriculum teaches students that they are either a part of, or apart from, the natural world. To teach economics, for example, without reference to the laws of thermodynamics or those of ecology is to teach a fundamentally important ecological lesson: that physics and ecology have nothing to do with the economy. In a sense, this is flawed education. The same is true throughout most of a school’s curriculum.

The guidelines in this document have been designed to try and provide teacher trainers and teachers with some tools, one possible framework, and some processes for bringing the environment into the realm of all subjects, not just those of science, as has traditionally been the case.

## What is the Environment?

The most general and probably best known definition for the environment is “everything that surrounds us”. This is pretty basic, broad and uninspiring. If we want people to develop proper values about wanting to protect the environment, we need a definition that

accounts for the complex ecological and social relationships among all species, particularly humans. Thus, a more inclusive definition is: “the environment is the complex set of physical, geographic, biological, social, cultural and political conditions that surround an individual or organism that ultimately determines its form and the nature of its survival.” Essentially, the environment is a hybrid, part biophysical and part social, for nowhere on the earth’s surface is there an environment (or nature) untouched by human impact. The environment is the product of both biophysical and social structures and processes, which we are a part of.

Furthermore, it seems that in order to be something that humans care about, it is crucial that any articulation of “environment” must emphasize the inextricable connections to human societies by using simple language to explain how the environment influences the way people live and the way societies develop. For that reason, people, progress, development and the environment are all closely linked. For development to be sustainable – to meet the needs of the present without compromising the ability of future generations to meet theirs – it is essential that people take into account environmental concerns just as strongly as they concentrate on economic progress.

## What are the Causes and Consequences of Environmental Problems?

The pressures on the world’s environment and ecosystems are numerous and come from myriad and diverse sources. Natural resources, land, water, forests and various animal species are being degraded or lost at an alarming rate in many places throughout the world. The reasons for the magnitude and rate of this destruction are many and complex. They include poverty, greed, untenable economic models, mismanagement of resources, lack of adequate education and trained personnel, under-development, deforestation, illegal dumping of hazardous wastes, global warming, the depletion of the ozone layer, pollution and many more. Essentially, an over-emphasis on economic development without environmental system considerations lies at the heart of why our planet’s environment is in such peril. See Annex 1: Global Environmental Issues, to find some of the core reasons for the different environmental issues and problems.

## How Can We Solve the World’s Environmental Problems?

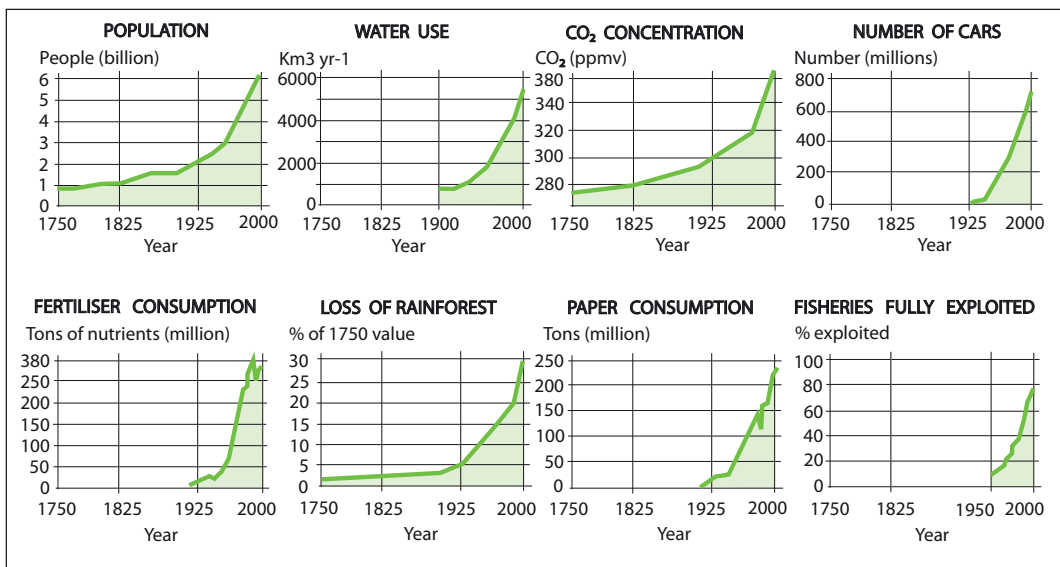
To say that a system or process is sustainable is to say that it can be continued indefinitely without depleting any of the material or energy resources required to keep it running. Trees, fish and other biological species are able to grow and reproduce at rates faster than those required just to keep their populations stable. This built-in capacity allows every species to increase or replace itself following natural disasters such as flash floods, extreme droughts or wildfires.

This ability to reproduce rather quickly makes it possible to harvest a certain percentage of trees or fish every year without depleting the forest or reducing the fish population below a certain unsustainable base number. As long as the number harvested stays within the capacity of the population to grow and replace itself, the practice can continue indefinitely. This is what is referred to as “sustainable yield.” It becomes non-sustainable only when the cuttings or catches exceed the capacity for the species to recover its numbers adequately to survive over time. Sustainable yield can also be applied to freshwater supplies, soils and the ability of natural systems such as the atmosphere or a river to absorb pollutants without being damaged. In contrast, the global trends illustrated in Figure 1 can all be seen to be racing ever more quickly beyond what can be considered sustainable yields. They are not sustainable!

Extending this concept further, we can speak of a sustainable society as a society that continues generation after generation, neither depleting its resource base by exceeding sustainable yields nor producing pollutants in excess of nature’s capacity to absorb them.

Therefore, when the concept of sustainability is applied to our modern society, it takes on added dimensions. Beyond just having our species survive, the sustainability of society implies preserving the capacity to explore, reflect on and understand new things, all the hallmarks and foundations of education.

Figure 1: Global Sustainability Trends



Source: Steffen et al., 2004. *Global Change and the Earth System: A Planet Under Pressure*. International Geosphere Biosphere Programme Series.



## What is the Role of Education in Helping to Solve Environmental Problems?

Environment and education are both vital elements of human existence that can be used to enhance the quality of the human condition. The environment provides the space and essential ingredients for life where humans are able to interact with each other, with the infrastructure and with the environment itself. On the other hand, education is the process and result through which teaching and learning operate. Through this process, knowledge, values, attitudes and skills are imparted to the learner. With the growing awareness of these environmental problems, consideration should be given to the types of educational programmes that can meet the requirements for creating a sustainable world.

There is no doubt that education is an essential component of development and one of its preconditions. In the Asian region, environmental education has been given a high importance and place in educational reform and innovation due to the pre-eminence of the natural environment in everyday life and culture. Concern for nature and natural resources has been a part of Asian civilization for hundreds of generations. The people of Asia share common scriptures and folklore, which are replete with examples that show how their ancestors were environmentally conscious and advocated concepts of sustained usage of resources through many social customs, myths, taboos, traditions and religious beliefs.

Thus, it is time to give careful thought to what type of integrated environment-based education will be most appropriate and how education can best address the current problems in each country. Do people need an understanding of ecological concepts or information about what is causing the problem? Are there specific critical thinking skills such as problem-solving or decision-making that can help them understand and tackle the problems? Are there practical skills that can help people solve the problems immediately, such as learning how to plant a tree, separate their garbage, recycle and compost? Are they motivated to get involved? Do they agree that environmental problems exist? If not, why not? All these questions assume a different form of "literacy" than has been defined in the traditional sense. We need an "ecologically focused literacy" if we are to conserve and maintain an environment that sustains the human species.

## Ecological Literacy

In education, we talk about basic literacy – the ability to read, write and do arithmetic. These skills are believed to be the underlying conditions necessary for people to successfully make a life for themselves and to follow the rules necessary to live in modern society. *Ecological literacy* may be something even more important, as we are talking about having the knowledge and competence to live on this planet for the foreseeable future and beyond. First coined by American educator David Orr and physicist Fritjof Capra in the 1990s, ecological literacy (also referred to as *ecoliteracy*) is the ability to understand the natural systems that

make life on earth possible. It introduces a new value to education: the “well-being of the earth” (Orr, 1992; Capra, 1995).

Basically, to be ecoliterate means understanding the principles of organization of ecological communities (i.e., ecosystems) and using those principles for creating sustainable human communities. An ecologically literate society would be a sustainable society that does not destroy the natural environment on which it depends. Ecological literacy is a powerful concept as it creates a foundation for an integrated approach to solving the world’s environmental problems. Advocates champion ecoliteracy as a new educational paradigm emerging around the poles of holism, systematic thinking, sustainability and complexity.

In summary, ecological literacy consists of understanding three inter-related concepts:

1. Having the knowledge necessary to comprehend inter-relatedness (i.e., how nature works).
2. Understanding how our society and economy (“human systems”) depend on clean air, water, soil and other resources (products of “natural systems”). A simple way this reality is often communicated is to say “everything is connected.” A study of these inter-connections highlights our dependence on the healthy functioning of the earth’s natural systems, which give us clean air, water, soil, food and all the other resources we depend on.
3. Understanding how human interactions with the environment can have both positive and negative impacts on people and the natural world. Essentially, this means that we must have an attitude of care or stewardship towards the environment coupled with the practical competence required to act on the basis of knowledge and feeling.

Some of these concepts have been part of many teachers’ programmes over the years. Here are a few simple examples:

- Science lessons about the water cycle or a food web are building blocks of ecological literacy because they reveal to the student how nature works.
- Social studies units focus on human communities (e.g., a family, neighbourhood, region or a country).
- Geography lessons on resource management contribute to ecological literacy as soon as the dependence and impact of the human system/community/region on natural systems is acknowledged and explored as a vital part of the story.

## Ecological Literacy and Systems Thinking

At the heart of becoming ecologically literate is learning to think about the world in terms of its systems, both human and natural, and the consequences of their interactions. When we think systemically, we acknowledge that the parts of a system (or systems) are highly interconnected. Making a single change usually results in a multitude of other changes.

Ecological literacy is about understanding the principles of organization of ecosystems and their potential application to understanding how to build sustainable human society. It combines the sciences of systems and ecology in drawing together elements required to foster learning processes toward a deep appreciation of nature and our role in it.

Systems thinking is the recognition of the world as an integrated whole rather than a collection of individual elements. Within systems thinking, basic principles of organization become more important than the analysis of various components of the system in isolation. Ecological literacy and systems thinking imply a recognition of the manner in which all phenomena are part of networks that define the way any element functions. Systems thinking is therefore necessary to understand the complex interdependence of ecological systems, social systems and other systems, at all levels.

With an understanding of ecological literacy, perceptions will naturally shift. Protecting the environment will become a basic principle for prioritizing thought and action in a sustainable society. In the face of the increasing capacity of industrial systems to destroy habitats and the climate system, the explicit declaration of the principles of ecological literacy, and the resulting awareness of the importance of living within the ecological carrying capacity of the earth, are increasingly necessary. Whether ecological literacy can address the infamous value/action gap is unclear.

## Environmental Protection: Where to Start?

To effectively integrate “environmental protection” into your existing curriculum, it is first important to know what the local, regional and national environmental problems are. It might help to make a list of all the environmental problems you can uncover and then cluster or group the problems according to type. For example, you could divide the problems into waste issues and into those involving the overuse of resources. You might also indicate which problems are most pressing in your local area and whether the problems affect a larger region of the country as a whole.

As you assess the environmental problems and issues, it is also important to think about, and list, what or who is causing the problems, what the consequences (ecological, health, social and economic) are, how the problems can be solved, and what is preventing these solutions from being implemented. In some cases, an environmental problem has many causes, and it is important to get to the root of the problem in order to figure out the best solution. For example, if deforestation is a problem, find out who is responsible for cutting the trees and why they are doing so. Is it farmers who are clearing the trees to plant crops? Is it timber companies selling the hardwood for profit? Or is it a government policy that is encouraging livestock grazing, palm oil cultivation or other economic activities? Maybe it is a combination of many causes.

There are many people and resources to help you assess the problems, their root causes, their effects on people and the environment, and their solutions. University professors; experts in the ministries of environment, agriculture or health, and experts working in conservation organizations in your area will be able to supply information about local and regional environmental problems.

The solutions will vary, depending on the severity of the problem and the resources available. For example, does the government (local or even national) need to set aside nature reserves or pass new environmental legislation, or establish fuel wood plantations? Can local communities take action themselves? For example, can they use better soil conservation techniques to prevent the washing away of tons of topsoil every year? Do people need training to solve the problems they are facing, such as a course to help them learn how to apply pesticides sparingly and safely? These are all important questions that you will need to ask before planning a unit or lesson on environmental protection.

## How Can Your Students Help Solve the Problems, Both Now and in the Future?

In thinking about local environmental problems, make sure to consider the role your students play in causing a problem and the role they could play in helping to solve the problem. For example, are they part of the problems now? How are their families connected to the problems? How well do your students understand the problems and from what perspective? Are they motivated to help find solutions? Have any students taken part in efforts to find solutions?

It's also important to think about the future role your students will play in the community. Will they be farmers or fishers, industrial workers or white-collar workers, religious leaders or politicians? Will they live in the capital city, in villages, or on small farms? Or will they be nomads? Will they hunt, gather firewood, vote in local and national elections, and so on? How will they relate to the environmental problems confronting the country and community, and how will they be able to help solve the problems?

You should also consider how students can help solve environmental problems now. Can they plant trees, design educational exhibits for the community, write to their government representatives, or help others learn how to plough on the contours? Depending on your background and experience, you might need to ask experts or colleagues about the types of solutions that make the most sense for your students and community.

# Tools and Guidelines for Curriculum Integration

## About the Tools and Guidelines

The tools and guidelines contained here for integrating environmental protection into the core science and social studies curriculum are adapted from the *AtKisson Accelerator* toolkit which was developed by Alan AtKisson and Associates of AtKisson Group over nearly twenty years of sustainability practice. The tools are copyrighted, but organizational/institutional licenses are available.

## The Compass: A Symbol of Direction and Sustainability

A compass is a tool for helping us to find direction, to assist us in going from Point A to Point B, C or D without losing our way. Magnetic compasses have been a part of human existence/experience for over 800 years.

Similarly, the Sustainability Compass is designed for finding direction, and for exploring and linking issues and people together from a 360 degree perspective. The Compass is an easy way to symbolize and remember the essential aspects of sustainability. It divides the world into four clear quadrants, while maintaining the feeling of wholeness in its circular shape. The use of such symbology reaches back thousands of years in our human story.

Sustainability is about the whole of our world, and it requires the engagement of issues and perspectives from every walk of life, and from every point on the map. It means planning our course to the future we desire, and setting a new direction. That is why the Compass is an effective symbol of sustainability. With the AtKisson Compass, the four directions are:

**Nature (N)** refers to the underlying health and sustainable management of key ecosystems, biogeo-physical cycles and natural resources. These can range from small, local and specific, like the quality of water of a nearby river or stream, to the large, global and general, such as a country's contributions to global warming through its greenhouse gas emissions.

### The Origin of the Compass of Sustainability

The Compass format grew out of an international dialogue of sustainability researchers. It is based on sustainability theory, but it makes the idea simple and intuitive. The Compass is used all over the world, by schools, cities, and companies, to help them orient toward sustainability and to teach others.



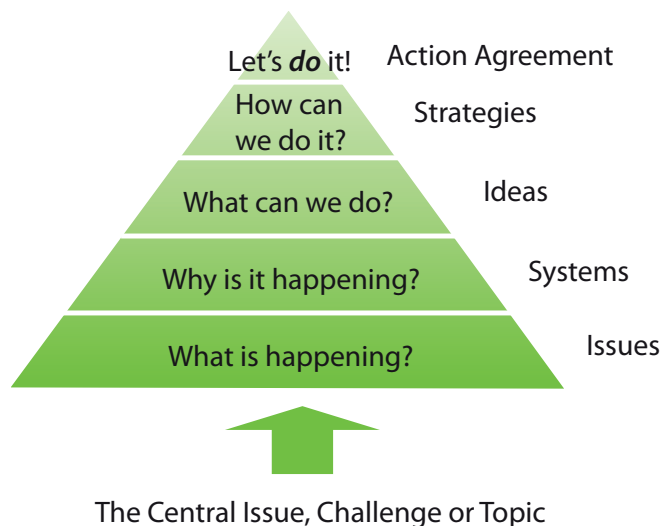
**Economy (E)** refers to all the ways human beings work with Nature, with knowledge and with each other to produce the things and services that they need or want. The core issues or topic areas for economy would relate to such things as production, jobs, markets, transportation, wages and labour conditions. Again, like in the nature example above, there would be differences based on location, sector considerations (organization, multinational corporation or small-medium enterprises), and scale or scope of the question (local, national, regional or global).

**Society (S)** is the category for the social systems, structures and institutions that are driven by people acting collectively. The emphasis here is on the collective rather than the individual. Issues might fall under or relate to some of the following: social cohesion, culture and arts, politics, laws and governance, planning and infrastructure, etc.

**Well-being (W)**, in contrast, focuses on the individual, as well as on the smaller webs of intimate relationships that are crucial to health and happiness. Well-being covers many issues that people are most concerned about in their daily lives but that are sometimes left out in traditional sustainable development models and approaches. These issues include personal health, access to education, quality of life, personal relationships with others, and general happiness and fulfillment.

The Compass is a convenient way to organize groups who are doing a workshop exercise. Working with the Compass ensures that we keep the entire “big picture” of sustainability in mind, that we respect and appreciate the diversity that we need to reach sustainability, and that we nurture the connections among the people that are the key to making sustainable development a reality.

## Guidelines: Steps for Incorporating Environmental Protection into Science and Social Studies Curricula



## Get Ready: Identify Learning Goals and Central Issue

What do you want the students to learn? What local issue do you agree to use as the central issue for teaching?

Use *Worksheet 1: Learning Goals* to identify what you want the students to learn in terms of knowledge, skills, perspectives and values.

### Step 1: Issues Identification (identifying environmental issues and related factors from four compass directions)

What is happening? Where do we want to focus? What is it linked to?

- **Environmental Issues Review and Brainstorming:** Use *Worksheet 2: Identify the Central Environmental Issues* to determine the local environmental issues. Refer to the list of global environmental issues in Annex 1. Then brainstorm (or research) what you think are the root causes of these issues, what impacts or effects do the issues have on sustainability in general (use whatever level is appropriate: individual, community, nation or planet), and finally how are the issues linked with national and/or global issues.

**Note:** You may choose to use the table of environmental issues provided in Annex 1, or you could develop your own table based on your ideas and the local situation.

- **Choosing your central issue:** Select one central issue that you will focus on for building a lesson. Use some criteria to weigh various issues in relation to each other, your curriculum requirements and needs, and the sustainability of your community (see Box 1).

- **Exploring stakeholder perspectives and roles:** Use *Worksheet 3* to first brainstorm a number of key stakeholder groups you feel are linked to the central issue and assign each person one stakeholder. Then use *Worksheet 4* to help each person think about what this particular environmental issue means to them as a stakeholder group, along with what they think their role (from their stakeholder perspective) is in contributing to the problem, in addition to what role they think they have in its solution. Facilitate a discussion among the groups by using a stakeholder wheel poster to help participants role-play stakeholder perspectives.

Ask the participants to fill out *Worksheets 3 and 4 (Stakeholder Perspectives and Roles)*.

#### Box 1: Choosing your Central Environmental Issue

Criteria for selecting the Issue you will build your lesson from:

- Relevant to your country or community and to the lives of the teachers and students
- Access to information on this topic either in your library, through the Internet or via local human resource people
- Relevance to your syllabus and curriculum requirements and needs

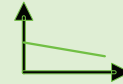
Use the Central Issue to frame your starting point and focus your group's discussion.

- **Behaviour over time graphing:** Next, develop a simple “Behaviour over Time” (BOT) trend graph for the central environmental issue. Groups must first agree on the measurement scale units that would be most appropriate to use. They will then develop a trend graph based on their answers to the following three questions:

- What is the situation now?
- In the past (whatever amount of time your group chooses), what was the situation like?
- In the future (again some timeframe agreed on by the participants), what do we think the situation will be if things stay the same in terms of policy making, training, institutional and human capacity building, organizational structure, people’s behaviour, etc. (i.e., business as usual)?

**Note:** During the group discussions in developing their graph, ask them to identify some important or key historical events that they feel influenced the magnitude and direction of the trend they have drawn. Use *Worksheet 5*.

### Box 2: Behaviour over Time Graphing



You draw a BOT graph in order to depict patterns of behaviour that you want to explore from a systems thinking perspective.

This type of exercise is an effective way to get teachers/students to divulge their own perspective and knowledge about a particular issue (i.e. why they think the situation is like this and what may have influenced it at different periods of time and so forth) and their underlying assumptions that they bring into understanding what is happening and what will happen in the future with the issue.

- **Identifying drivers and effects:** Next, identify what factors contribute to the central environmental issue by way of causing the problem either directly or indirectly. We call this group of factors “pressures” or “drivers”. At the same time, identify the consequences of the environmental problem continuing in the direction that it is currently going. We call this group of factors “responses” or “effects”. Use *Worksheet 6* for this exercise.

After finishing the list of drivers and effects, consider those factors from all four Compass directions (refer to the AtKisson Compass attachment to help you identify what sort of factor could go into each Compass sector) and fill them into the second table in *Worksheet 6*.

**Optional:** If you have been working in small groups, pull the whole group together for a quick sharing of what each small group has identified and discussed.

**Note:** Any of the steps described above can be shortened, depending on the time that you have to conduct the workshop, the number and background of the individuals participating in the planning, and how deep you want to go with the learning that takes place alongside the planning.



## Step 2: Systems Thinking (finding connections and linking issues across sectors and finding leverage and doorways for curriculum units and standards)

How do things relate? Where can we integrate into the curriculum?

- **Consider the linkage pathways:** Now consider the central environmental issue and its trend again. Have a discussion (either as a whole group or in your small groups) focused on this question: *Why is this problem happening?*

Look at the “Drivers and Effects” sub-issues and factors that you identified linked to the main environmental issue from the Step 1 discussion.

Now see if you can find the patterns and connections. Are there some pressures/drivers that seem more primary than others? Are there some that seem to be working together, in some way, to drive the central issue/trend (in good or bad ways)? How about the responses or effects that the issue is producing? How are they related to the main issue and each other? Can you find causal relationship pathways between them? Do they feedback somewhere to the original pressures or drivers? Refer to the *Systems Example* that is attached, and use *Worksheet 7* for this exercise.

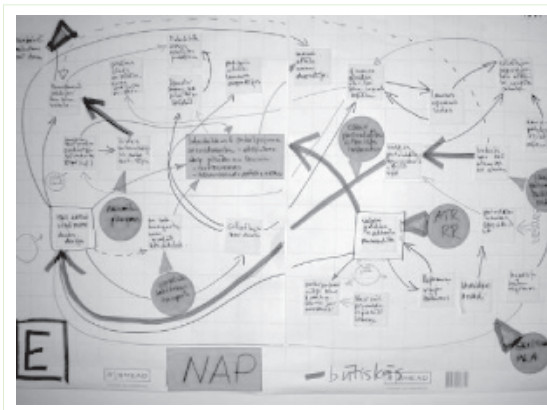
- **Develop a systems relationship map:** Take the central issue and create a systems map around it on a large piece of flip chart paper or newsprint. Use sticky notes (with colours for each element corresponding to the Compass point that it is associated with).

Nature = Green                  Society = Yellow

Economy = Blue                Well-being = Pink

Use the sticky note cards so that groups can move things around on the map as they work together to figure out the linkage/relationship pathways. First, use pencil to draw connecting lines with arrows to show the linkage and direction of influence. Once they have settled on how the system works, they can trace back over their pencil lines with marker to make them more visible.

**Note:** On the maps, “pressures/drivers” to the central issue should be on the left side of the paper and “responses/effects” on the right side. Some elements may be placed in the middle, as they are connectors between pressures and responses.



**Important note:** See if you can identify any “*feedback linkages*” that exist from “effects” back to primary “drivers”. Feedback loops are crucial insights for positive system change.

- **Finding “leverage points” for system change:** Once the system linkages are complete, the next step is to see where in the system that has just been mapped out the school or students could make a positive contribution in tackling central environmental issues through an action project linked to the syllabus. We call these places where we can make the most effective and long-term system changes, “*leverage points*”. Mark these places on the system map with small “delta” signs (triangles), like this: ▲
- **Finding our curriculum doorways:** The last step of the systems level is focused on finding the points of connection to our syllabus, or what we call “*curriculum doorways*”. These are places that we can integrate the environmental issue into our curriculum and syllabus. These places will be marked on the system map with a small circle, like this: ●

Have the team(s) review their syllabus units and learning requirements and have them work to crosslink these to any place in the system diagram that they created. Places where they find linkages to their science or social studies syllabus units they should designate with a ● and also put a post-it note next to it summarizing what the linkage is and to which unit, lesson or standard.

Use *Worksheet 7* for this step as well. See the attached example to see how this is done.

If you are working in small groups, have each group summarize its results briefly for the others.

### **Step 3: Lesson/Activity Ideas (selecting lesson activity ideas that will allow us to successfully integrate “environmental protection” into core curriculum units and/or lessons)**

Ideas for environmental protection-related lessons, activities and/or projects: what can we do?

Now comes the fun part: thinking up exciting, powerful, creative new ideas and ways to teach our existing syllabus, but in a way that integrates environmental issues and environmental protection (remember: Environmental Protection = Action). First, take some time (5 or 10 minutes) to have people (individually or in pairs) brainstorm ways to teach the syllabus that link with the central environmental issue and deal with a strong protection aspect.

- **Ideas brainstorming:** Encourage each person to think about the key insights from the previous step. Now that we understand something about *why* this environmental issue is a problem and what is happening, how can we bring it into our curriculum? What can we do to involve students in helping to solve this issue?

Remind the group that brainstorming is a time for innovative, “out-of-the-box” ideas, as well as ideas that seem practical and familiar. All ideas are welcome!

Teachers should look at the leverage points and curriculum doorways that they have identified and mapped out, and find a place to ask the following questions: “How can I teach about this issue at a particular curriculum doorway? Can my students also contribute to doing something real to solve this issue, or at least to contribute towards its solution?”

Use *Worksheet 8* to brainstorm as many lesson ideas as you can, though three or four of them should be plenty to start with.

- **Presenting ideas and getting feedback:** Summarize the project ideas on sticky notes or cards. Give them descriptive titles that will be easy for other people to understand.

Have each person share his/her best or favourite ideas with the group, in small groups first, if you are working in Compass Point teams, or otherwise with the whole group. Designate some time for people to discuss and give constructive feedback to each person’s lesson ideas.

**Note:** If your participants would like to work across subjects, they can do preference voting by putting the pieces of paper with the project ideas up somewhere, where people can see them.

Give each person a certain number of votes, depending on the number of ideas presented. Each person can vote for any idea – except their own! And they can split their votes up, or concentrate them on one or two project ideas.

If you have time, develop some criteria for selecting the “best” ideas for lessons, such as:

- Location (where?)
- Availability of materials
- Time needed

### Box 3: What Learning Approach Do I Want to Take?

Since we are dealing with Environmental Protection, as mentioned before, this usually translates into some type of action or behaviour change outcome.

Thus, we must contemplate the approach we will take with our lesson. Do we take a . . .

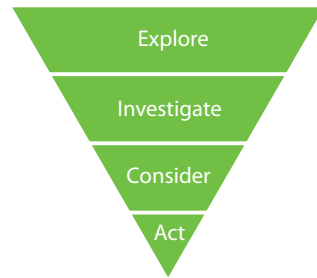
1. A Project-based Learning Approach (PBL) with an Action component; or
2. An Experiential Learning, but classroom based, Approach.

- Background knowledge and experience of teacher
- Other factors

If one lesson idea is a clear "winner," that idea moves to the next step, Step 4. Otherwise, if there are several ideas that are popular, have a second vote, or have a discussion to see if you can come to a consensus. (Note: sometimes, several ideas can be combined into one lesson that stretches over a period of time.)

**Note:** For more about the Project-based Learning Project Planning Form, see Annex 4.

One Project based Learning Approach



### Step 4: Strategy and Lesson Planning (developing a lesson plan that addresses environmental protection and sustainability as well as teaching for ESD)

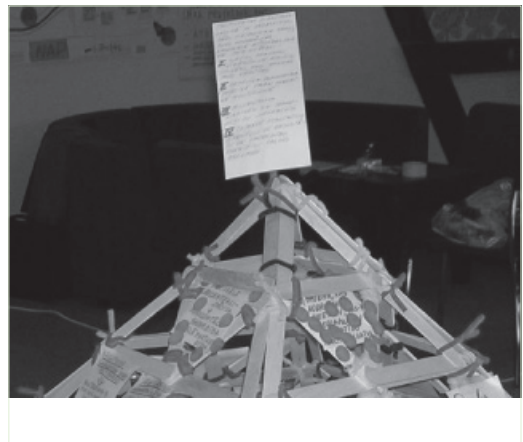
Using the lesson planning framework provided (*Worksheet 9: ESD Curriculum Integration Planning Framework*), develop a fairly complete lesson plan.

**Note:** If the lesson you are creating requires more extensive planning, then make a "plan to plan." Identify who is going to be involved, when, and what they will need (help, information, and approvals) to create a finished plan.

### Step 5: Capstone: an Agreement to Act!

Now, summarize the commitment the teaching team is making to realize the new curriculum initiatives. Put this "Agreement to Act" in the form of a short written statement: "We commit to....."

This agreement is a sign of your group's consensus to make change towards infusing ESD into your curriculum through thematic integrations into core subject areas. Have everyone who is willing to commit to the statement sign their name to it. (*Worksheet 10: Agreement to Act*)



**Celebrate your success!** You have taken a big step toward applying ESD in order to help create a more sustainable world!

## Evaluation and Assessment

Evaluate your integrated unit.

After implementing the lesson plan, you can evaluate the integrated unit by yourself. You can also ask your colleagues to give you some feedback concerning your curriculum improvement. (*Worksheet 11: Evaluate your Integrated Unit*)

**Optional:** You can create questions for your evaluation based on your own situation.

## Curriculum Integration Worksheets

### Worksheet 1: Learning Goals

Please identify the learning goals in terms of the knowledge, skills, perspectives and values that you want the students to learn.

What basic knowledge is necessary for the students to learn or understand?

What skills are necessary for the students to learn?

What perspectives are necessary for the students to learn?

What values are necessary for the students to live by sustainably in their community?

Adapted from McKeown, R., 2002. *Education for Sustainable Development Toolkit*. Version 2, July 2002. Energy, Environment and Resources Center, University of Tennessee.

## Worksheet 2: Identify the Central Environmental Issues

### Environmental Issues Brainstorming

**Instructions:** List all local environmental issues you and your group can think of, then brainstorm (or research) what you think are the root causes of each issue, what impacts or effects does the issue have on sustainability in general (use whatever level is appropriate: individual, community, nation or planet), and finally, how is the issue linked with national and/or global issues.

Local Environmental Issues			
Issue name	Root causes	Impacts or effects on sustainability	How is this issue linked with national and/or global issues?

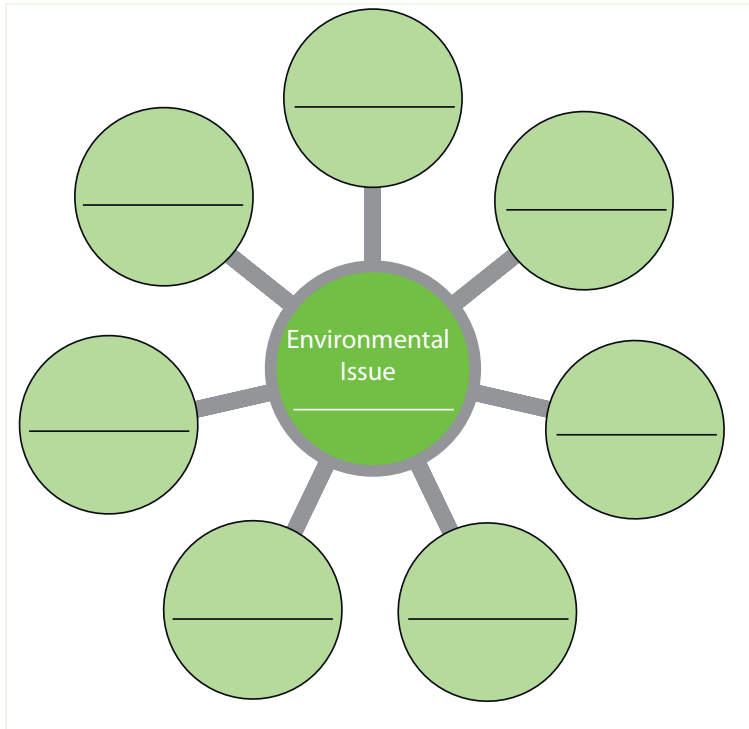
After brainstorming and discussion, the issue that you/your group agree to use as the central environmental issue is.....

Example: Stakeholder Perspective Wheel for a particular environmental issue: **Water Pollution.**



### Worksheet 3: Stakeholder Perspective Wheel

**Instructions:** In the circle, write in the names of seven key stakeholders related to your central environmental issue.



## Worksheet 4: Stakeholder Perspectives and Roles

**Instructions:** List your own stakeholders and those of the others in your group. Then write down what you think is the role of each of your own stakeholders in this environmental issue and how they see or view this issue from their own perspectives. During the discussion, write down what the others say about their own stakeholders.

Stakeholder	How do they perceive this issue? What does this issue mean to them (their lives, their jobs, etc.)?	What do you think is their role in this issue both as contributor to the problem and in working towards its solution (from an outside objective perspective)?



## Worksheet 5: “Behaviour over Time Graphing”

The *Behaviour over Time (BOT) graphs* are a type of systems thinking tool. Like other basic graphs, they have horizontal and vertical axes, with a line showing how something is changing over time.

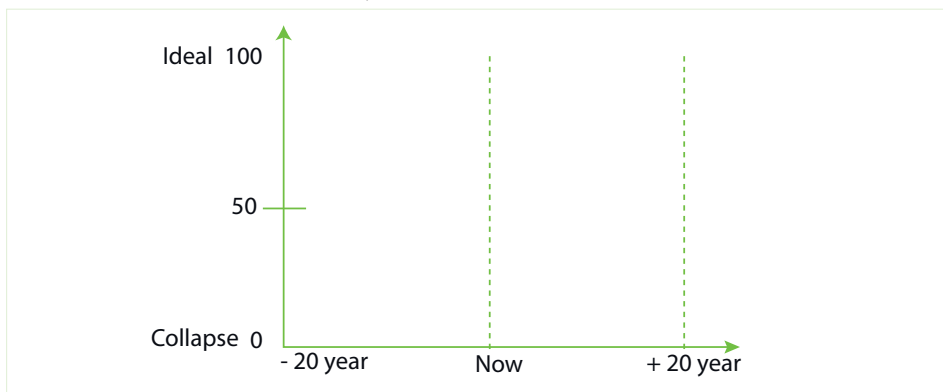
You draw a BOT graph in order to depict patterns of behaviour that you want to explore from a systems thinking perspective. This type of exercise is an effective way to get teachers/ students to divulge their own perspectives and knowledge about a particular issue (i.e., why they think the situation is like this and what may have influenced it at different periods of time and so forth) along with their underlying assumptions. This exercise allows individuals to better understand the “world view” others have in relation to the same problem.

**Instructions:** With your team/group:

1. Develop a simple BOT or “trend” graph for the central issue that you will build a lesson around.
  - A. Agree on your measurement scale units.
  - B. Start at the present and assess the situation of your issue in relation to your scale. Where do you think you are now?
  - C. Then, go back in time (twenty years) and assess what the situation was at that time in relation to this issue.
  - D. Finally, agree as a group on what the situation will be in the future (twenty years) if nothing much is done to change policy making, training and institutional and human capacity building, organizational structure, or people’s behaviour, etc. (i.e., business as usual).

**Note:** Remember that you should answer this last question as best you can remembering that it does not sit in a vacuum and is already being driven by other local, national, regional and global trends.

2. Identify some important or key historical events that you feel have influenced the magnitude and direction of the trend you have drawn.



# The AtKisson Sustainability Compass



## Nature

- Natural resources use and management (water, air, soil, forests, etc.)
- Land use patterns
- Pollution & environmental quality
- Environmental policy, laws & regulations
- Impact on biodiversity (wildlife and vegetation)
- Ecosystem services (e.g. clean water, oxygen generation, CO<sub>2</sub> sequestration )
- Indoor built environment

## Well-being

- Quality of life (work/life balance)
- Physical and mental health
- Sense of personal security
- Working & living conditions
- Education & training
- Relationships
- Spiritual fulfilment
- Happiness



## COMPASS

## Economy

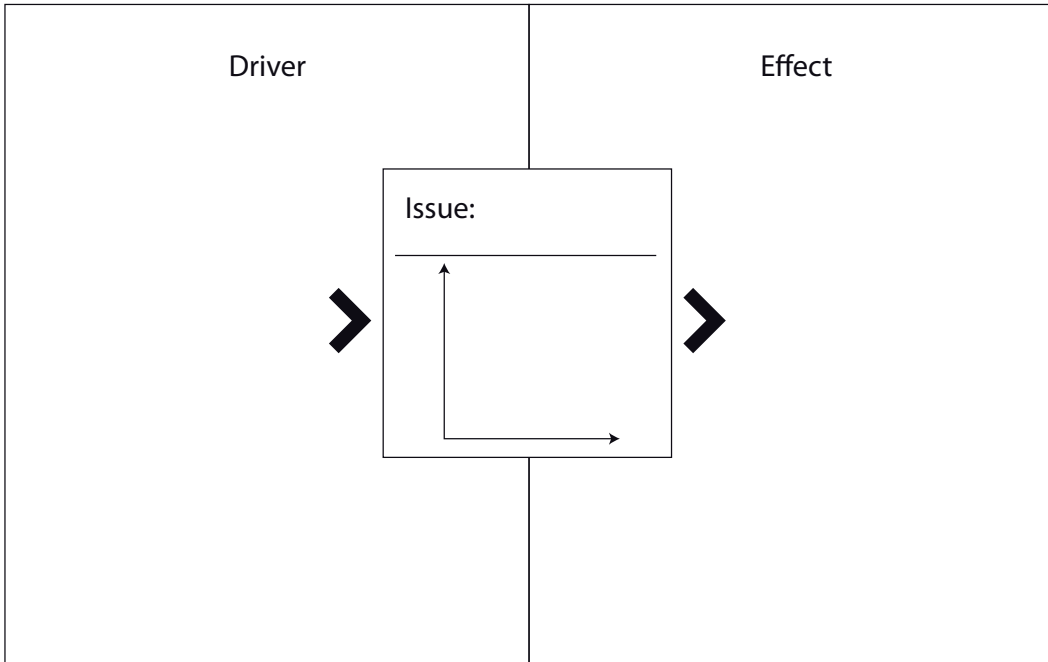
- Purchasing and resource procurement
- Consumption patterns (energy, raw materials, water, etc.)
- Fiscal budgets
- Employment levels
- Wages & benefits
- Transportation (how people travel)
- Cost of living & inflation

## Society

- Social cohesion among different groups
- Governance and transparency
- Public services (waste management, water, electricity, etc.)
- Social services (child care, health care, education, etc.)
- Ethnic and gender diversity
- Family/work team structure and relationships
- Cultural diversity, identity and preservation
- Corporate social responsibility (CSR)

## Worksheet 6: Brainstorming Drivers and Effects

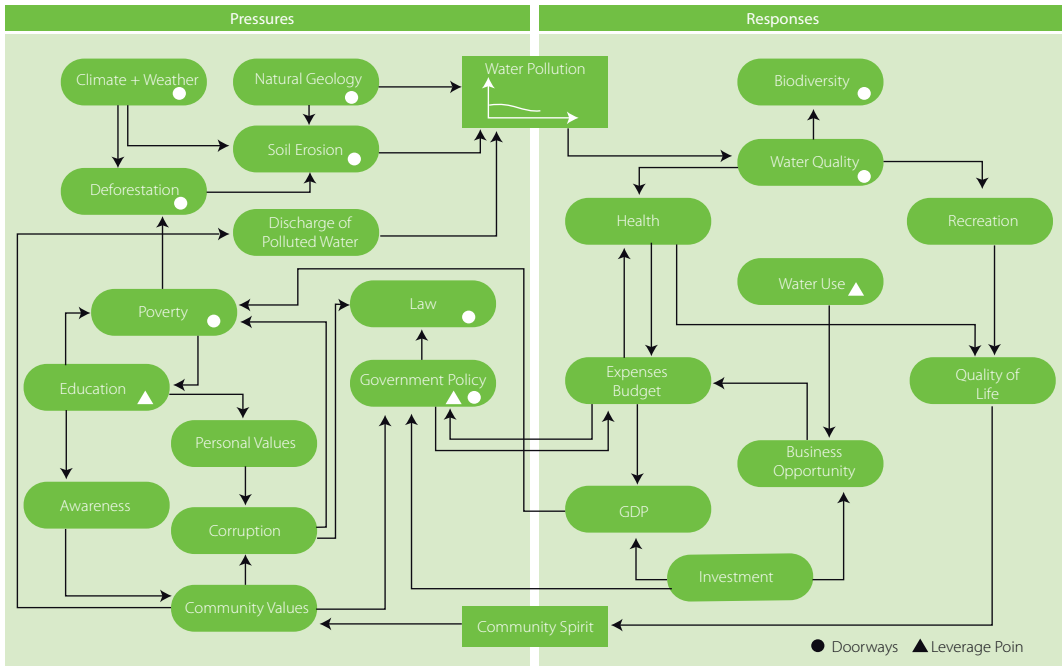
**Instructions:** Write down your central environmental issue and its BOT trend in the middle of the worksheet, then brainstorm as many factors as you can that relate to this issue. Separate these factors into either “pressures/drivers” or “responses/effects” according to the issue’s trend trajectory.



After finishing the list of drivers and effects, consider those factors from all four Compass directions (refer to the AtKisson Compass attachment to help you identify what sort of factor could go into each Compass sector) and fill them into the table below.

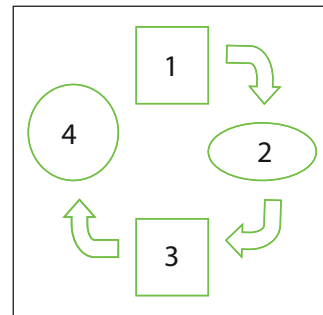
Nature	Economy	Society	Well-being

### Example Issue System Relationship Map



### Worksheet 7: Issue Relationships, Leverage Points and Curriculum Doorways Map

Use this sheet to work out your ideas about how different elements related to your central environmental issue might link together in cause-and-effect, systemic terms. Then identify the Leverage Point (the place where students can make changes) for you to link your existing syllabus and/or national standards to the central issue or an associated sub-issue from any Compass Point dimension. **KEEP IT SIMPLE.** There is no wrong way to do this exercise!



## Worksheet 8: Lesson Ideas Brainstorming

**Instructions:** With the results of the systems analysis, brainstorm a list of lesson “ideas” that could effectively integrate the central environmental issue/topic into your existing curriculum/syllabus. Use the columns on the right to identify the “curriculum doorways” and the syllabus linkages related to this lesson.

Doorways (from the Systems Map)	Activity or lesson idea	What are the links to my syllabus and/or standards?
1. .... The leverage point that this doorway will lead to is .....		
2. .... The leverage point that this doorway will lead to is .....		
3. .... The leverage point that this doorway will lead to is .....		
4. .... The leverage point that this doorway will lead to is .....		

## Worksheet 9: ESD Integrated Thematic Lesson Planning Framework

Thematic Topic Area: (example: Water Pollution)		Name of Lesson: Time Required:	
1. <b>Science/Social Studies Syllabus Linkages</b> (for workshop use... what are the linkages with science/social studies syllabus?)		2. <b>Key Concepts</b> that can be elaborated from this thematic topic	
3. <b>Essential or Driving Question of the Lesson</b> (linked to what is the key message or understanding that students should know from this lesson)		4. <b>Focus, Bridge and Process Questions</b> (questions that you will use at the beginning of the lesson to introduce the lesson and links to learner's past experience and interest)  <b>Focus Questions:</b>  <b>Bridge Questions:</b>  <b>Process Questions:</b>	
5. <b>Lesson Assessment Questions</b> (questions that you will use to assess student understanding)			
6. <b>Interdisciplinary Links/Strands to Keep In Mind</b> (for teaching and assessment)			
<b>Concepts</b> Form, function, change, causation, connection, interdependence, perspective, collaboration, reflection, responsibility, etc.	<b>Physical, Personal and Social Learning</b> Health (physical and mental) and physical education, interpersonal development (values), personal learning, citizenship, etc.	<b>Other Learning (Interdisciplinary)</b> Communication, leadership, design, creativity, critical thinking, technology (ICT), etc.	
7. <b>What do we want the students to learn?</b> (related to the key elements in the curriculum standards from the Ministry of Education)			
8. <b>Activity Description</b> (describe/summarize the activity... what will students do and what will they learn?)			
<b>Activity Outline in Relation to Key Learning Modalities</b> – break down the lesson in relation to key learning modalities such as: hands-on investigation, discovery learning, categorizing and describing, analysis and interpretation, creativity, passive listening, dialogue and discussion.			
<b>Learning Assessment</b> – how you will know what the children have learned.		<b>References and Resources for This Lesson</b>	
<b>Action Component</b> – describe how the lesson will incorporate an action component; i.e., have students actively contribute towards some form of solution related to the central environmental issues/problems.			

Source: Adapted from Marcia Behrenbruch, IBO Asia-Pacific Conference 2007.

## Worksheet 10: Capstone Proposal and Agreement

### Instructions

The *Capstone Agreement* is the final step of this workshop. It is an action, or set of actions, that the entire group agrees to take on that will further the lessons learned or ideas generated from the workshop. It creates a connection between the workshop experience and real life.

Each team should develop the Capstone Proposal. The proposal should meet the following criteria:

- The proposal should be realistic.
- The proposal should support education system change.
- The proposal should consider the results of the integrated process and how it will enhance teaching and learning for sustainable development.
- The entire workshop group should feel it is able to support the proposal.

Each teaching team presents its Capstone Proposal, which is recorded on large paper on the wall in front of the group. Once all Capstones have been proposed, discussion ensues about common themes and connections between the proposals before crafting an agreement statement based on the four proposals.

### Team Capstone Proposal

Capstone Proposal
-------------------

Capstone Agreement
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## Worksheet 11: Evaluate the Integrated Unit

Use the questions below to reflect on your integrated unit.

1. What links did you make among the subject areas?

2. What links did you make with the community?

3. In your view, what aspects of the integrated unit engaged and inspired the students?

4. How effectively did your unit incorporate the ESD (knowledge, skills, perspectives and values) into environmental protection?

5. What would you do differently the next time?

6. What ideas and suggestions do you have for improving the integrated unit process?

Source: Adapted from Integrated Unit, The Gary and Jerri-Ann Jacobs High Tech High Handbook



## Annex 1: Global Environmental Issues

Global Environmental Issues			
Issue Name	Root Causes	Impacts or Effects on Sustainability	Possible or Proposed Solutions
Acid Rain	<ul style="list-style-type: none"> <li>• Acid rain is a result of air pollution. Burning fuel of any type releases different chemicals into the atmosphere.</li> <li>• Power stations, factories and cars burn fuel, resulting in toxic polluting gases.</li> <li>• Some of these gases (especially nitrogen oxides and sulphur dioxide) react with the tiny droplets of water in clouds to form sulphuric and nitric acids.</li> </ul>	<ul style="list-style-type: none"> <li>• Acid rain has serious effects on forests. Trees grow more slowly because the soil dissolves and washes away the nutrients and minerals which help the trees to grow.</li> <li>• Acid rain causes the release of harmful substances such as aluminum into the soil and wears away the waxy protective coating of leaves, damaging them and preventing them from being able to undertake photosynthesis properly.</li> </ul>	<ul style="list-style-type: none"> <li>• Reducing emission by reduced burning of fossil fuels; using the cheapest ways to produce electricity</li> <li>• Finding alternative sources of clean energy, for example, solar energy, windmills, hydro power</li> <li>• Greater subsidies of public transport by the government to encourage people to use public transport rather than always traveling by car</li> <li>• Every individual can make an effort to save energy by switching off lights when they are not being used and using energy-saving appliances. When less electricity is being used, pollution from power plants decreases</li> <li>• Walking, cycling and sharing cars all reduce the pollution from vehicles</li> </ul>

Global Environmental Issues			
Issue Name	Root Causes	Impacts or Effects on Sustainability	Possible or Proposed Solutions
Air Pollution	<ul style="list-style-type: none"> <li>• Sources of air pollution are both natural and human-based.</li> <li>• Pervasive use of fossil fuels for combustion purposes for transportation and electricity generation all over the world</li> <li>• Design of cities and other human spaces in ways that increase the incidence of air pollution</li> <li>• Weak laws and regulations that would monitor and regulate emissions from cars and factories</li> <li>• Deforestation, especially contributing to desiccation of land resulting in dust storms</li> <li>• Ineffective or expensive pollution technology is preventing developing countries from reducing their pollution emissions</li> </ul>	<ul style="list-style-type: none"> <li>• The effects of air pollution are diverse and numerous. Air pollution can have serious consequences for the health of human beings, and also severely affects natural ecosystems.</li> <li>• Ozone and other photochemical oxidants in the upper atmosphere are also highly toxic to both plants and animals.</li> <li>• Toxic chemicals in the air include carcinogenic chemicals, radioactive materials, and other chemicals (such as asbestos, vinyl chloride, and benzene) that are emitted as pollutants.</li> <li>• The dying off of vegetation in large urban areas and damage to crops and forests downwind of urban centres is mainly caused by exposure to ozone and other photochemical oxidants.</li> </ul>	<ul style="list-style-type: none"> <li>• Developing and communicating the scientific knowledge and understanding required to appreciate the significance of ecosystems</li> <li>• Analysing the effects of air pollution on human beings</li> <li>• Actively engaging with the process of developing policy</li> <li>• Building the capacity to identify air pollution problems and to identify and implement policies to reduce their impacts</li> <li>• Developing and implementing suitable controls</li> <li>• Undertaking a massive systems switch to renewable energy</li> <li>• Using new technology to increase energy efficiency</li> </ul>

## Global Environmental Issues

Issue Name	Root Causes	Impacts or Effects on Sustainability	Possible or Proposed Solutions
Biodiversity Loss	<ul style="list-style-type: none"> <li>• Pressures from exploiting for commercial value</li> <li>• Large-scale clearing and burning of forests</li> <li>• Over-harvesting of plants and animals</li> <li>• Indiscriminate use of pesticides</li> <li>• Draining and filling of wetlands</li> <li>• Destructive fishing practices (cyanide, blasting of coral reefs)</li> <li>• Air pollution</li> <li>• Conversion of wilderness to agricultural and urban uses</li> <li>• Wildlife trade (hunting/trapping)</li> <li>• Import of alien species</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of intricate web of ecological relationships that provide innumerable ecological functions</li> <li>• Sharp decrease in food security</li> <li>• Loss of economic resources and business</li> <li>• Habitat loss for a host of species from mammals to insects, bacteria and fungi</li> <li>• Loss of community values and culture, especially cultures with strong ties to certain species</li> <li>• Loss of knowledge about life that humans have not yet discovered or do not understand</li> </ul>	<ul style="list-style-type: none"> <li>• Increasing awareness of the interconnectedness of all life and encouraging a sense of cooperation and sharing among all humans and other living creatures on earth</li> <li>• Maintaining a balance between all populations in the biotic community</li> <li>• Protecting the world's diversity of species as integral to a sustainable future</li> <li>• Resource use planning</li> <li>• Providing information, knowledge and appropriate tools for local people</li> <li>• Promoting awareness in the use of resources</li> <li>• Monitoring and sound management of natural resources</li> </ul>

Global Environmental Issues			
Issue Name	Root Causes	Impacts or Effects on Sustainability	Possible or Proposed Solutions
Coastal Erosion	<ul style="list-style-type: none"> <li>• Wave action</li> <li>• Climate change and weather</li> <li>• Resource extraction</li> <li>• Vegetation</li> <li>• Coastal management</li> <li>• Transportation</li> <li>• Deforestation</li> <li>• Shrimp farming</li> <li>• Tourism development</li> <li>• Natural disasters (tsunami)</li> </ul>	<ul style="list-style-type: none"> <li>• Erosion in one location may result in accretion nearby.</li> <li>• Coral bleach resulting in decrease of fishing resources</li> <li>• Algae bloom (toxic varieties may be harmful to humans)</li> <li>• Property loss</li> <li>• Loss of businesses</li> <li>• Beach deterioration</li> </ul>	<ul style="list-style-type: none"> <li>• Reforestation</li> <li>• Zoning and land use planning through stakeholder engagement</li> <li>• Improving knowledge, awareness in regard to vegetation, deforestation and shrimp farm management</li> </ul>
Deforestation	<ul style="list-style-type: none"> <li>• Land tenure issues</li> <li>• The logging industry fueled by the need for disposable products</li> <li>• Acid rain killing forests in some countries</li> <li>• Harmful effects of building dams</li> <li>• Consumption on a huge scale worldwide of forest products such as paper, chop sticks, and general building construction material</li> <li>• Institutionalized and endemic corruption</li> </ul>	<ul style="list-style-type: none"> <li>• Loss of environmental resources</li> <li>• Loss of social and cultural traditions</li> <li>• Loss of the economic and productive capacity of forest land</li> <li>• Loss of biodiversity</li> <li>• End of food security and sustainability of livelihoods as provided by forests</li> <li>• Declining climatic and water resource conservation benefits provided by forests</li> <li>• Loss of the rich medicinal resources stored in forests</li> <li>• Higher risk of disaster occurring in communities, including flooding and mudslides</li> </ul>	<ul style="list-style-type: none"> <li>• Creating “payment for ecological services” for preserving forests in developing countries</li> <li>• Building awareness of the value of forests in all aspects of human life</li> <li>• Strengthening government forest policy</li> <li>• Passing community forest laws</li> <li>• Strengthening sustainable forestry certification schemes</li> <li>• Tackling poverty in rural areas</li> <li>• Reducing paper use</li> </ul>

Global Environmental Issues			
Issue Name	Root Causes	Impacts or Effects on Sustainability	Possible or Proposed Solutions
Global Warming/ Climate Change	<ul style="list-style-type: none"> <li>• On a global scale, carbon dioxide, water vapour and other trace gases in the atmosphere keep the sun's energy from radiating back out to space, thus sealing it inside the earth's atmosphere</li> <li>• Economies of the world driven by use of non-renewable fossil fuel energy sources</li> <li>• Lack of government will power and thus lack of sufficient laws and regulations on fossil fuel use and emissions</li> <li>• Lack of technology and knowledge development on using renewable energy sources up to now</li> </ul>	<ul style="list-style-type: none"> <li>• Damage to soils, forests, and lakes downwind of heavy pollution sources, possibly leading to altering the entire biosphere</li> <li>• Health issues: new diseases, varieties of flu, etc.</li> <li>• Food security</li> <li>• Increasing energy consumption</li> </ul>	<ul style="list-style-type: none"> <li>• Increasing the role of scientists in the crafting of policy and government boldness in taking action (political leadership from nongovernmental organizations was crucial in bringing about the Montreal Protocol)</li> <li>• Reducing emission of greenhouse gases</li> <li>• Energy conservation through use of energy saving appliances, devices and good energy conservation behaviour (e.g. switching off lights, appliances, when not in use)</li> <li>• Massive economic switch to renewable energy sources</li> <li>• Stop burning agricultural waste</li> <li>• Stop deforestation of primary forest</li> </ul>

Global Environmental Issues			
Issue Name	Root Causes	Impacts or Effects on Sustainability	Possible or Proposed Solutions
Ozone Depletion	<ul style="list-style-type: none"> <li>• Stratospheric ozone depletion has a negative impact on the environment</li> <li>• Sources of acid deposition reveal the presence of two acids, sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) and nitric acid (HNO<sub>3</sub>)</li> </ul>	<ul style="list-style-type: none"> <li>• They are oxidized by hydroxyl radicals to sulfuric and nitric acids, which dissolve readily in water or absorb on particles and are brought down to earth in acid deposition.</li> <li>• The impact on ecosystems, however, became apparent when anglers started noticing sharp declines in fish populations.</li> <li>• Impact on aquatic ecosystems is extremely critical because ozone depletion affects the functioning of virtually all enzymes, hormones, and other proteins in the bodies of all organisms.</li> <li>• Much of the damage of acid precipitation to forests is due to chemical interactions within the forest soils.</li> </ul>	<ul style="list-style-type: none"> <li>• Protecting our atmosphere while also achieving the economic benefits that people value.</li> <li>• Alternative power plants, and reduced consumption of electricity</li> <li>• Washing coal to remove sulfur is costly, both economically and environmentally.</li> </ul>

Global Environmental Issues			
Issue Name	Root Causes	Impacts or Effects on Sustainability	Possible or Proposed Solutions
Soil Erosion	<ul style="list-style-type: none"> <li>• Destructive agricultural practices</li> <li>• Surface mining, hydro-mining</li> <li>• Urban/suburban development</li> <li>• Affects both agriculture and the natural environment.</li> <li>• Soil compaction, low organic matter, loss of soil structure, poor internal drainage, salinity, and soil acidity problems.</li> </ul>	<ul style="list-style-type: none"> <li>• Desertification</li> <li>• Contamination of water sources</li> <li>• Loss of topsoil and other essential plant nutrients from the soil</li> <li>• Farmland threatened through reduced crop production potential, lower surface quality and damaged drainage networks</li> <li>• Soil deterioration through faster infiltration rates</li> <li>• Lanes, roads and fence rows washed out</li> <li>• Crop production technology to increase yields in spite of soil erosion</li> <li>• Crops totally ruined so that costly reseeded is necessary</li> </ul>	<ul style="list-style-type: none"> <li>• Conservation, particularly at the farm level, revised agriculture policies and changing international market forces</li> <li>• Rapid diffusion and implementation of proper agricultural practices to replace destructive traditional or modern practices like mono-cropping</li> <li>• Soil conservation laws and economic incentives for farmers and businesses</li> <li>• Increased investment into agricultural areas</li> <li>• Organic farming methods</li> </ul>

Global Environmental Issues			
Issue Name	Root Causes	Impacts or Effects on Sustainability	Possible or Proposed Solutions
Solid Waste (landfills/ dumps, incinerators, plastics, hazardous waste)	<ul style="list-style-type: none"> <li>• Buildup of solid waste, defined as the total of all materials thrown away from homes and commercial establishments</li> <li>• Closing of old dumps and landfills</li> </ul>	<ul style="list-style-type: none"> <li>• Water percolating through waste materials may cause chemicals in the materials to dissolve and flow away.</li> <li>• Solid waste is potentially subject to natural decomposition.</li> <li>• But some waste materials (e.g., plastics) are resistant to natural decomposition.</li> <li>• Landfills situated below the water table (new landfills should be established on high ground, well above the water table)</li> </ul>	<ul style="list-style-type: none"> <li>• Reducing the amount of waste at its source</li> <li>• Changing lifestyles so that people reduce the use of disposable products and excessive packaging</li> <li>• Making an effort to reduce the amount of materials that are thrown out</li> <li>• Environmentally concerned consumers putting pressure on producers to reduce their packaging</li> <li>• Decreasing the weight of many items to reduce the amount of material used in manufacturing</li> <li>• Recycling paper, glass, and aluminum</li> </ul>



## Global Environmental Issues

Issue Name	Root Causes	Impacts or Effects on Sustainability	Possible or Proposed Solutions
Water Pollution	<ul style="list-style-type: none"> <li>• Every year, 14 billion pounds of sewage, sludge, and garbage are dumped into the world's oceans. Nineteen trillion gallons of waste also enter the water annually.</li> <li>• Millions of people live along coastlines and near rivers, meaning that these bodies of water are likely candidates for heavy and destructive pollution.</li> <li>• Many cities and countries dump sewage out at sea. Often, they place it not far from their own coastline, often killing all the sea wildlife in the dumping area.</li> <li>• Chemicals dumped by industries and governments are another major source of water pollution</li> </ul>	<ul style="list-style-type: none"> <li>• The effects of water pollution are varied and depend on what chemicals are dumped and in what locations.</li> <li>• Water pollution kills life that inhabits water-based ecosystems. Dead fish, birds, dolphins, and many other animals often wind up on beaches, killed by pollutants in their habitat.</li> <li>• Loss of community values and culture</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding the role of water management in sustaining and diversifying livelihood, particularly in regard to poverty reduction</li> <li>• Specifically focusing on measuring the costs and benefits of water management and infrastructure</li> <li>• Providing integrative knowledge that can bridge science and policy and utilize interdisciplinary approaches</li> <li>• Coordinating socio-economic assessments and policy analysis</li> </ul>

## Annex 2: Eleven Basic Ecological Concepts

1. Ecology is the part of biology that examines the interrelationships between organisms and their environment. It also draws heavily upon, and contributes to, other areas of biology, other sciences like chemistry, physics, meteorology and earth science, and to other fields like mathematics, economics, medicine and sociology. As practitioners of a basic science, ecologists seek an accurate understanding of natural phenomena through observation and experimentation. At the same time, ecologists seek to utilize the gathered information toward preserving the ability of the earth to sustain all forms of life (including humans). Like those of other sciences, ecological concepts can change based on new findings and on new interpretations of old data.
2. In nature, a variety of physical and biological factors influences an organism's ability to grow and reproduce in any one place.
3. There is variability in the way that different species respond to the environment, and that causes them to have different ranges. However, a species' actual presence on a site depends upon its ability to disperse onto that site, as well as its ability to survive its environment.
4. Organisms of a given species that occur together comprise a population. Populations can grow, but various environmental factors prevent populations from growing indefinitely. Populations can also decline to the point of extinction.
5. Species that have similar responses to the environment are typically found together in assemblages called communities. Each community is unique, but those occurring in similar environments are generally similar to one another. Adjacent communities often blend into each other.
6. On any site, the organisms interact in various ways. Some help each other while others are harmful.
7. All of the organisms on a site, along with its physical environment, comprise an ecosystem.
8. All ecosystem functions depend upon energy. In any given ecosystem, organisms called producers obtain energy from the non-living environment (usually the sun) and convert it into a biologically useful form. Other organisms called consumers obtain that energy by eating the producers and/or other consumers.
9. The bodies of all organisms are built from chemical elements called nutrients. In any ecosystem, producers obtain various nutrients in the form of gases and minerals from the air, soil, and/or water and convert them into biologically useful forms. Consumers obtain these nutrients by eating producers and/or other consumers. Decomposers convert the nutrients back into their non-biological form.
10. Ecosystems are constantly changing, either rapidly or slowly. Those changes can be due to changes in physical factors, to the arrival or local extinction of the component species, to the organisms progressing through their life cycles, to altered relationships between the species, and to the species changing by evolution.

11. More than any other species, humans have changed the earth's ecosystems. At present, ecologists are particularly concerned about preservation of biological diversity, the effects of global climate change, and the ability of ecosystems to sustain life.

## Annex 3: Designing Lesson Questions

### The Art of Questioning

To produce a world of critical and creative thinkers that can help solve environmental problems, we need to encourage students to ask questions and think critically. To do this, we need to ask them the right kinds of questions and model good questioning techniques.

Although factual questions are important, they should be balanced with more stimulating questions that make students think about something differently, come to a different conclusion, or reflect on something important. There are many different kinds of questions that can help students grow intellectually and creatively. And there are many strategies for using questions in your teaching. For example, one type of questioning strategy, called "Socratic questioning," is designed to probe deeply and get students to think. It also helps open up discussion and allows students to express themselves freely without worrying about being wrong.

### Examples of Socratic Questions:

- How do people decide which career to take? How should they decide?
- Why is having a clean river important? What does it require to have a healthy and clean river?
- Why do factories and businesses have a tendency to pollute the environment? How could they improve?
- What do you think?

There is a logical sequence of different question types for a lesson:

1. **Focus questions**, the most basic kind of question, ask for specific information. They often begin with "who, what, or where." For example:
  - What have you heard about acid rain?
  - What does this snail shell feel like?
  - What do you know about an owl that makes it such a great night hunter?
2. **Process questions** have a wider scope of possible responses than focus questions. Process questions ask people to integrate information rather than just remembering or describing.

Process questions often begin with “What does this mean? What would happen if ...? What experience supports ...? Why did ...? For example:

- What evidence indicates pollution is affecting the Chao Phraya River?
- How does a stork feed its young?
- Why are there more water hyacinths in this section of the river?

3. **Evaluative questions** usually deal with matters of value, choice or judgment of the participants. They offer group members a chance to express their feelings. Evaluative questions often begin with “What do you think? What about ...?” For example:

- What do you think should be done to clean up the Chao Phraya River?
- How could we all individually help in this effort?
- Why do you think that the temple doesn’t want as many birds around?
- Why is it important to have different kinds of trees in a forest?

## Annex 4: Project Planning Form

Project title: .....
Teacher(s): .....
School:.....
Grade level(s):.....
Subjects:.....

STANDARDS-FOCUSED  
PROJECT-BASED LEARNING  
Buck Institute for Education

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### Begin with the End in Mind

Summarize the theme for this project. Why do this project?
Identify the content standard that students will learn in this project (two to three per subject).
Identify key skills students will learn in this project. List only those skills you plan to assess (two to four per person).
Identify the habits of mind that students will practice in this project (one to two per project).

Does the project meet the criteria for standards-focused PBL?

## Craft the Driving Question

State the essential question or problem statement for the project. The statement should encompass all project content and outcomes, and provide a central focus for student inquiry.

Have you posed an authentic problem or significant question that engages students and requires core subject knowledge to solve or answer?

## Plan the Assessment

Step 1: Define the learning outcomes and project outputs for the project. What will you assess?

Early in the Project:

During the Project:

End of the Project:

## Plan the Assessment (2)

Step 2: State the criteria for exemplary performance for each outcome/output:
outcome/output:  Criteria:
outcome/output:  Criteria:
outcome/output:  Criteria:
outcome/output:  Criteria:

Do the outcome/output and criteria align with the standards and outcomes for the project?

## Map the Project

What do students need to know and be able to do to complete the tasks successfully? How and when will they learn the necessary knowledge, skills, values and perspectives? Look at one major product for the project and analyse the tasks necessary to produce a high-quality outcome.

Product:			
Knowledge and Skills Needed	Already have Learned	Taught before the Project	Taught during the Project
What project tools will you use? <input type="checkbox"/> Know/need to know lists <input type="checkbox"/> Daily goal sheet <input type="checkbox"/> Journals <input type="checkbox"/> Briefs <input type="checkbox"/> Task lists <input type="checkbox"/> Problem logs		<input type="checkbox"/> ..... <input type="checkbox"/> ..... <input type="checkbox"/> ..... <input type="checkbox"/> ..... <input type="checkbox"/> ..... <input type="checkbox"/> .....	

Do the objectives/outcomes and tasks give all students the opportunity to demonstrate what they have learned?



## Map the Project (2)

List the key dates and important milestones for this project.

With other teachers and/or a group of students, refine the project design to guide you further in your planning. What other thoughts do you now have on the project?

What challenges or problems might arise in this project?

## Manage the Process

List preparations necessary to address needs for differentiated instruction for special needs students, or students with diverse learning styles.

How will you and your students reflect on and evaluate the project?

- Class discussion
- Fishbowl
- Student-facilitated formal debrief
- Teacher-led formal debrief
- Individual evaluations
- Group evaluations
- Other

What do you expect to learn from this project?

## Annex 5: Bibliography and Resources

AtKisson, A. 2008. *The ISIS Agreement*. Earthscan.

Braas, J. and Wood, D. 1994. *Environmental Education in the Schools: Creating a Program That Works!* Washington, D.C., U.S. Peace Corps.

Capra, F. 1995. *The Web of Life*. New York, Harper Collins.

McKeown, R. 2002. *Education for Sustainable Development Toolkit*. (Version 2). Energy, Environment and Resources Center, University of Tennessee.

Orr, D. 1992. *Ecological Literacy: Education and the Transition to a Postmodern World*. Binghamton, N.Y., SUNY Press.

Steffen, W., Sanderson, A., Tyson, P.D., Jäger, J., Matson, P.A., Moore III, B., Oldfield, F., Richardson, K.H., Schellnhuber, J., Turner, B.L., and Wasson, R.J. 2004. *Global Change and the Earth System: A Planet Under Pressure*. The International Geosphere Biosphere Programme Series. Springer-Verlag Berlin Heidelberg New York.

Sterling, S. 2003. *Whole Systems Thinking as a Basis for Paradigm Change in Education*. Ph.D. thesis, University of Bath, UK.

### Web Resources

#### North American Association of Environmental Education (NAAEE)

<http://www.naaee.org/publications/publications-descriptions>

Celebrating 38 years of promoting excellence in environmental education! NAAEE is the professional association for environmental education. Our members promote professional excellence in nonformal organizations, K-12 classrooms, universities (both instructors and students), government agencies, and corporate settings throughout North America and in over 55 other countries. Since 1971, the Association has created opportunities for its members to improve their skills in creating and delivering programmes and services that teach people how to think, not what to think.

#### Center for Environmental Education (CEE) - Green Teacher

[http://www.greenteacher.org/?page\\_id=108](http://www.greenteacher.org/?page_id=108)

There are hundreds of teachers, educational institutions, nature clubs, NGOs and citizens groups in the country working to create awareness about the environment. The efforts of these groups range from helping create a love for nature through camping and adventure, development of educational material, raising awareness about ecosystems, to campaigning against polluting industries and lobbying the government. Their efforts offer learning for others who would like to use education and communication to bring about change. Selected case experiences of such education-communication initiatives are shared.

## **Education for Sustainable Development Toolkit**

<http://www.esdtoolkit.org/default.htm>

The Education for Sustainable Development Toolkit will help schools and communities develop a process for creating locally relevant and culturally appropriate education. This toolkit is based on the idea that communities and educational systems need to dovetail their sustainability efforts. Ideally, local education systems can reorient existing curricula to reinforce local sustainability goals.

The ESD Toolkit is an easy-to-use manual for beginning the process of combining education and sustainability.

## **AtKisson Group**

[www.atkisson.com](http://www.atkisson.com)

AtKisson Group is an international network of affiliated organizations and individual associates around the world. Members of the Group are fully authorized to use and promote the ISIS Method and the ISIS Accelerator suite of sustainability tools.

## **Acorn Naturalists**

<http://www.acornnaturalists.com>

Acorn Naturalists has provided educators with unique resources for teaching about science and nature. From creative, hands-on kits, to games, field equipment, animal replicas, optics, activity guides and DVDs, the Acorn Naturalists' collection provides exemplary resources for the field and classroom.

## **Educating for a Sustainable Future**

<http://www.education.ed.ac.uk/esf/index.html>

The site is dedicated to providing online supported self-study materials for courses in education for sustainability in teacher education. As the site advocates whole school approaches to education for sustainability, it should be of interest to primary and secondary teachers regardless of their area of curricular specialization. The site consists of resources linked to a study guide, which provides suggested activities that should enhance the practice of citizenship through education for sustainable development in schools.

## **Facing the Future**

<http://www.facingthefuture.org>

Facing the Future believes in the transformative power of widespread, systemic education to improve lives and communities, both locally and globally. The positive, solutions-based programming is designed by and for teachers, and brings critical thinking about global issues to students in every walk of life. The goal is to work within the education system to help teachers help students achieve academic success, while preparing them to create and maintain positive, healthy, and sustainable communities. Facing the Future provides curriculum resources, teacher workshops, and service learning opportunities used by teachers, schools, and districts in all 50 states and over 60 countries.

## **YOU Think!**

<http://www.youthink.worldbank.org/about>

We give you information about the global issues that matter to you. Check out the research, knowledge and experience gathered by World Bank experts on international development.

## **Mongabay.com**

<http://www.mongabay.com/about.html>

Mongabay.com is one of the world's most popular environmental science and conservation news sites. The news and rainforests sections of the site are widely cited for information on tropical forests, conservation, and wildlife. Mongabay.com aims to raise interest in wildlife and wildlands while promoting awareness of environmental issues.

## **National Curriculum, UK**

<http://curriculum.qca.org.uk/News-and-updates-listing/News/Cross-curriculum-dimensions-news.aspx>

The cross-curriculum dimensions are essential tools to help young people make sense of the wider world. They should permeate the curriculum and the life of a school. The planning guides will help teachers put the dimensions at the heart of lessons and ensure that learners understand the challenges that face the world today, such as creating a sustainable future for the planet.

## **The Nuffield Foundation**

<http://www.primaryhistory.org/leadinghistory/cross-curricular-learning,295,SAR.html>

This website helps teachers and children to “do history”, based on the seven key principles of Nuffield Primary History and a wide range of teaching methods. There are lots of free lessons to download, as well as information about History and Literacy and cross-curricular learning.

## **International Commission on Education for Sustainable Development Practice**

[http://mdp.ei.columbia.edu/sitefiles/file/Exec\\_Summary-Int'l\\_Commission\\_on\\_Education\\_for\\_Sustainable\\_Dev\\_\\_Practice.pdf](http://mdp.ei.columbia.edu/sitefiles/file/Exec_Summary-Int'l_Commission_on_Education_for_Sustainable_Dev__Practice.pdf)

Finding a lack of comprehensive cross-disciplinary programmes to train practitioners in the full range of challenges of sustainable development, the Commission proposes a set of recommendations for a new educational system focused on sustainable development practice. Central to the Commission's recommendations is the proposed Master's degree in Development Practice programme. With emphasis on policy and implementation, the MDP programme is rooted in four main disciplines: health sciences, natural sciences and engineering, social sciences, and management. The Commission's recommendations are designed to meet the world's rapidly growing demand for highly skilled sustainable development practitioners.

## **Children's Identify and Citizenship in Europe**

<http://cice.londonmet.ac.uk/pdf/2002-63.pdf>

In October 2001, a major curriculum reform in Greece reorganized subject content, reconsidered the place of subjects, and defined wider educational philosophy. In these reforms, the citizenship education curriculum appears to be different from earlier content-driven curricula. Citizenship has been coherently organized across compulsory education, and provision made for interdisciplinary and cross-thematic approaches to learning, building on and examining contemporary socio-political and economic issues.

## **Environmental Learning and Experience: An Interdisciplinary Guide for Teachers**

[http://www.bced.gov.bc.ca/environment\\_ed/ele\\_maps\\_intro.pdf](http://www.bced.gov.bc.ca/environment_ed/ele_maps_intro.pdf)

The ELE Curriculum Maps have been developed to help teachers turn theory into practice for environmental learning by connecting learning outcomes across K-12 curricula with elements of the ELE Guide. Teachers adept at integrating the environment and sustainability into their practice are often well aware of these curriculum links, while others may find the connections less obvious. These maps help to show us where the connections already exist, and how we might further incorporate environmental themes into our teaching and learning.

## **An Interdisciplinary Model for Teaching the topic "Foods": A Contribution to Modern Chemical Education**

[http://www.uoi.gr/cecp/2004\\_May/pdf/06Petrrou.pdf](http://www.uoi.gr/cecp/2004_May/pdf/06Petrrou.pdf)

Modern chemical education aims at teaching based on critical thinking, problem-solving and decision-making that may be developed through an interdisciplinary approach. An interdisciplinary model for teaching the topic "foods" is suggested. The goal of the suggested approach is for students to develop their evaluative thinking in order to adopt responsible behaviour in regard to health.

## **Social Studies and Science Education: Developing World Citizenship through Interdisciplinary Partnerships**

[http://www.quasar.ualberta.ca/css/Css\\_35\\_3/ARDeveloping\\_world\\_citizenship.htm](http://www.quasar.ualberta.ca/css/Css_35_3/ARDeveloping_world_citizenship.htm)

This paper explores the possibilities that interdisciplinary projects in science and social studies have for developing world citizenship. Using the example of a joint project designed around monoculturing, the authors argue that students can develop the analytic skills, reflective qualities, and global awareness necessary to become hopeful and active citizens in the twenty-first century.

## **Rikkyo University – Centre for ESD Research**

<http://univ.rikkyo.ac.jp/research/laboratory/ESD/eng/index.html>

The ESDRC conducts interdisciplinary research on ESD within the humanities and social sciences. The Centre is developing a network of ESD research in the Asia-Pacific. You will find lots of good data and research on what is happening in ASEAN as well as other Asia-Pacific countries in ESD.

## **Global Footprint Network**

<http://www.footprintnetwork.org/index>

Global Footprint Network serves as the steward of the National Footprint Accounts, the calculation system that measures the ecological resource use and resource capacity of nations over time. Based on approximately 4,000 data points per country per year, the Accounts calculate the Footprints of 152 countries from 1961 to the present. These accounts provide the core data that are needed for all Footprint analyses worldwide.

## **Sustainable Development on Campus: Tools for Campus Decision Makers**

<http://iisd1.iisd.ca/educate>

This site includes learning modules, case studies, action plans, environmental policies, resources, forums, and contacts - all designed to help administration, students, or faculty implement sustainable development on campus - and also includes links to a "bookshelf" of key reports and guides covering university leadership, green campus administration, curriculum issues, and student actions.

## **Sustainability Education**

<http://www.urbanoptions.org/sustainedhandbook/TheApproach.htm>

This site offers the "Multi-strand Approach," which gives teachers a way to customize current curricula to include sustainability concepts. This approach involves changing one's teaching structure from teaching discreet individual topics to choosing a theme and teaching all subjects from within this theme. "Mining a topic from all angles" is a standard style of teaching for K-5 enclosed classrooms, but can be adopted for all grade levels.

To customize current curricula, visitors to the site can link to a list of Sample Activities or consult the Criteria Evaluation to quickly interject varied concerns not included directly within the curriculum. The Criteria Evaluation provides basic guidelines to help teachers evaluate whether or not their curriculum embraces sustainability concepts. This tool is designed to simplify the complex process of incorporating sustainability content into the curricula by breaking down sustainability into its essential, but not inseparable, components.

## **Teaching and Learning for a Sustainable Future (a UNESCO site)**

<http://www.unesco.org/education/tlsf>

This is a multimedia, interactive professional development programme with materials, exercises, and links that help educators deepen their understanding of education for sustainability and its importance in addressing the economic, social, and environmental issues of the world.

This site presents key education issues that form the rationale for Education for a Sustainable Future (ESF), including:

- A basic understanding of sustainable development;
- Help in understanding the range of social, economic, and environmental issues facing the world today; the interrelationships among these different types of issues; and the ways that education is key to the empowerment of people working for a sustainable future;
- “Future studies,” which explore different ideas and perspectives about the future and include exercises designed to examine personal views as well as writings by futurists, consider probable versus preferable future scenarios, and incorporate these ideas into the curriculum;
- Various strategies for the education community to reorient education toward the broader process of building a sustainable future.

The exercises help develop an appreciation of the range of ESF objectives regarding knowledge, values, and skills, as well as an understanding of the broad scope of actions needed to reorient education. Key themes include the evolving nature of interdependence, citizenship/stewardship, rights of future generations, diversity; quality of life, uncertainty; and sustainability.

## Second Nature

<http://www.secondnature.org>

This site offers guidance and assistance to institutions of higher education in their efforts to make sustainability an integral part of the institution and expand sustainability into personal and community life. The site is designed for a range of audiences and includes resource guides for faculty, administration, and students. These resource guides foster an understanding of sustainability issues and provide examples of how others are working together across traditional boundaries in both campus and community. The site’s Resource Center section, originally known as Starfish, provides an extensive database of syllabi for courses that address environmental themes. The Alliance for Sustainability through Higher Education is a multi-institution effort to foster awareness and initiatives related to education for sustainability.

- **The Faculty Guide** highlights faculty who are engaged in including the principles of sustainability in their teaching, learning, research, and practices. It also provides resources related to curriculum change and design, interdisciplinary course syllabi, innovative course projects, faculty development, and collaborative efforts for institutional change.
- **The Student Guide** is designed for college and university students who are actively promoting Education for Sustainability. It provides links to resources that can bolster efforts to initiate or continue effective and collaborative change for sustainability on campus, in the curriculum, in research, and in surrounding communities.
- **The Administrator Guide** provides tools and resources to help institutions reflect on their role in the future of the planet, learn more about incorporating sustainability into the institution’s agenda, and link to other institutions and administrators who are implementing sustainability goals.



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Educational, Scientific and  
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