

## Lesson #7: Re-stabilizing Earth – 4 Guiding Ideas of The Natural Step

<b>Stage 1 – Desired Results</b>	
<p><b>Established Goals: GLO C, GLO D</b></p> <ol style="list-style-type: none"> <li>1. Demonstrate appropriate critical thinking skills</li> <li>2. Understand processes and conditions in which equilibrium occurs (ie the 4 guiding ideas aim to restore equilibrium by decreasing the rate at which persistent synthetic compounds are added to the environment – ie focus is on Guiding Idea #2 and #4 though #1 and #3 can be explored)</li> </ol>	
<p><b>Understandings:</b> Students will understand that...</p> <ol style="list-style-type: none"> <li>1. Adherence to science-based system conditions when making decisions is necessary to maintain the “stabilization” (equilibrium) of ecosystems’ structure and function.</li> <li>2. Mental models about sustainability must adhere to fundamental principles of science such as the first and second laws of thermodynamics in order to move toward sustainability</li> <li>3. Science-based decision-making models such as The Natural Step’s 4 sustainability guidelines can be used to help make decisions about how to TAKE-MAKE-WASTE more sustainably.</li> </ol>	<p><b>Essential Questions: SLO C3:</b> How can the Natural Step’s 4 sustainability guidelines be used to help make decisions about how to TAKE-MAKE-WASTE more sustainably?</p>
<p><b>Students will know...</b> <b>SLO B2:</b> Characteristics of The Natural Step decision-making model <b>SLO D3:</b> Processes and conditions in which equilibrium occurs (ie the 4 guiding ideas aim to restore equilibrium are based on the first and second laws of thermodynamics – 1. Energy and matter can change form but cannot be created or destroyed 2. Entropy – things tend to move toward disorder and away from order – direct students to think of their bedroom. Solar energy can return dispersed energy to usable forms and that is why solar energy and the process of photosynthesis is so important (relates to the creation of carbon compounds)</p>	<p><b>Students will be able to...</b> <b>SLO C4:</b> Employ effective communication skills to share scientific and technological ideas and data</p>
<b>Stage 2- Assessment Evidence</b>	
<p><b>Knowledge:</b> <b>SLO B2:</b> Assess their ability to communicate the four guiding ideas in their own words <b>SLO D3:</b> Assess their understanding of the basic scientific principles behind the 4 guiding ideas of The Natural Step (ie can they verbalize for example “nothing is created/destroyed” and “things tend to get more disordered and less ordered”</p>	<p><b>Skills:</b> Assess the letter that the students write to the world in terms of how it compares to their previous assignment My Mental Model</p>
<b>Materials Required</b>	
<p>Powerpoint Presentation “Examining Our Mental Models” Educator reading – “The Pixies in the Box” reading (p.34-38 from Robèrt, K. (2002). <i>The natural step story: seeding a quiet revolution</i>. Gabriola Island, British Columbia: New Society Press.) Powerpoint Presentation “Examining Our Mental Models” (includes two captions: <b>The Economic Perspective: Expanding Circular Flows and The Ecological Worldview: Linear Irreversible Throughput. Reference: Wackernagel, M. and Rees, W. (1996). Our Ecological Footprint: Reducing Human Impact on the Earth. Gabriola Island, British Columbia, Canada: New Society Publishers.</b>) HANDOUT: Letter From An Alien (source: Porritt, J. (2000). <i>Playing Safe: Science and the Environment</i>. New York: Thames &amp; Hudson) From: <i>Playing Safe: Science and the Environment</i> by Jonathon Porritt. Copyright ‘c’ 2000 Jonathon Porritt. Reproduced by kind permission of Thames &amp; Hudson Ltd, London. HANDOUT: Four Guiding Ideas for Becoming More Sustainable (p.67-74 from Robèrt, K. (2002). <i>The natural step story: seeding a quiet revolution</i>. Gabriola Island, British Columbia: New Society Press.)</p>	

HANDOUT: How to Use the 4 Guiding Ideas in Your Organization (p.64-67 from **Robèrt, K. (2002). *The natural step story: seeding a quiet revolution. Gabriola Island, British Columbia: New Society Press.***)

Students need originals (or copies) of their previous Assignment: My Mental Model

Poster Board for the students original versions of the 4 guiding ideas of The Natural Step (or access to powerpoint or art supplies, etc.)

**DVD:** Captain W Productions. (n.d.). Ecology of Commerce. Schumacher College: Dartington Totnes Devon, UK: Captain W Productions (Title 2: Paul Hawken Ecology of Commerce 31:30-37:17)

### Stage 3 – Learning Plan

1. **Slides 20-22** INITIATE DISCUSSION so as to compare nature mental models to human mental models whenever possible. Add to the display boards.  
(nature is cyclic vs humans are thinking in linear take-make-waste mental models)
2. Review Water Cycle, Carbon Cycle, Nitrogen Cycle if necessary to demonstrate cyclic mental models of nature
3. **Slides 23 & 24** DISCUSS two captions that show two different mental models:  
The Economic Perspective: Expanding Circular Flows  
The Ecological Worldview: Linear Irreversible Throughput  
Reference: Wackernagel, M. and Rees, W. (1996). Our Ecological Footprint: Reducing Human Impact on the Earth. Gabriola Island, British Columbia, Canada: New Society Publishers.
4. **Slide 25** - HANDOUT: Letter From an Alien. Have students read and comment on whether we have a shared mental model for earth. We certainly may BUT is it a model that is leading to a healthy environment and society?
5. Revisit the mental model you described on the previous assignment titled “My Mental Model”. Just as the alien did, write a letter to the world telling them what YOU think are the MOST IMPORTANT things that need to happen to “re-stabilize the earth” (Try for 5-10 items). Think of how your mental model might change and how it might stay the same as it did before.
6. **Slide 26** A man named Karl Henrik Robert, a Swedish oncologist thought about how the world could be “re-stabilized” and he came up with these **four guiding ideas for becoming more sustainable**.
- Slide 27** is a more visual representation of the 4 guiding principles.
7. SHOW students **DVD:** Captain W Productions. (n.d.). Ecology of Commerce. Schumacher College: Dartington Totnes Devon, UK: Captain W Productions (Title 2: Paul Hawken Ecology of Commerce 31:30-37:17\* see notes in )
8. **Slide 28** DISCUSS the word sustainability. SUGGEST the definition “...the capacity for continuance into the long-term future” (Porritt, 2005). Provide a good example: You might be able to stay up all night to study for one exam and still be alert enough to write the exam. However, that is not sustainable. You would not be able to continue staying up all night for the long-term. Eventually (quickly) your body would not function properly.
9. **Slide 29** – Use this and other examples to decide what is sustainable and what is not.
10. Reinforce that these 4 guiding ideas are based on fundamental principles of science such as the first and second laws of thermodynamics. “The Pixies in the Box” (p. 34-38 is a good visual example of how these laws are basic scientific principles) – change “pixies” to something more applicable for your students’ context if you wish. Use the Mystery Box to aid in the description.

11. **HANDOUT:** 4 Guiding Ideas for Becoming More Sustainable. **DIRECT** students to read this and **SUMMARIZE** the four guiding ideas in their own interpretation of each one.(individually) Reinforce that it is more practical to phrase each one as “Organizations must....”

12. Students meet with their group members. **HANDOUT:** How to Use the 4 Guiding Ideas in Your Organization. Have students read these within their organization groups and highlight those strategies that might apply to their organization.

13. **GUIDE** students (now in groups) in making a poster of the 4 ideas, or a visual representation of each idea and share the results to fortify the meaning of each one. Use examples referred to in the reading and provide more background information where there are gaps. Reinforce

\* it is more practical to phrase each one as “Organizations must....”

\*the importance of the word “systematically”

\*that it is the rate which is important – the rate at which we extract compounds that are not commonly found in nature/produce persistent synthetic compounds cannot **EXCEED** the rate at which nature can deal with them. If nature can recycle them for us, then the problem is significantly minimized.

14. **Slide 30 - PROJECT LINK**→ Return to your TAKE Report now. **DISCUSSION** and one-on-one help may be necessary depending on the level of knowledge and experience of students.

### **Extension Learning Activities**

#### **Educator Background on The Natural Step**

More information can be found at <http://www.naturalstep.org/com/nyStart/> including videos that are very understandable. Karl Henrik Robert (and multitudes of others in the scientific community) tried to narrow down the most important things humans would have to stick to in order to move toward sustainability. If an organization sticks to these 4 guiding ideas when making decisions, they will always be moving toward sustainability. There are many other guiding ideas out there but Robert’s is based on the basic scientific principles that allow ecosystems to maintain their structure and their function and so it is a science-based guide to becoming more sustainable.

Educator Reading  
“The Pixies in the Box”

p. 34-38 from **Robèrt, K. (2002). *The natural step story: seeding a quiet revolution.***  
**Gabriola Island, British Columbia: New Society Press.**

**Copyright not obtained**

Four Guiding Ideas for Becoming More Sustainable

p.67-74 from **Robèrt, K. (2002). *The natural step story: seeding a quiet revolution.***  
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How to Use the 4 Guiding Ideas in Your Organization

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Teacher Notes

See The Natural Step's Website for graphics to help explain the four system conditions

*<http://www.naturalstep.org.nz/tns-f-system-conditions.asp#thefour>*

### Letter from An Alien

From: *Playing Safe: Science and the Environment* by Jonathan Porritt. Copyright © 2000. Johnathan Porritt. Reproduced by kind permission of Thames & Hudson Ltd., London.

From then on, the complexity and diversity of life forms on Earth gradually increased, notwithstanding a number of cataclysmic 'extinction spasms' which destroyed most life forms present during those periods. But each time diversity built back up again, so that biologists now calculate there are more species on planet Earth than there have ever been before. And no doubt it would build back up again even if (in the most apocalyptic of eco-scenarios) we manage to wipe out millions of species in the process of wiping out our own.

Those who talk therefore of 'the human species destroying life on Earth' are clearly guilty of hyperbole. But that doesn't mean (as has often been argued) that proponents of such views are reconciled to continuing environmental devastation (in our terms) on account of the fact that (in evolutionary terms) it's little more than a passing pin-prick. Even if you strip away the fantasies of us being in control, and the arrogance of those who suppose that the unique purpose of 3.5 billion years of evolution was to produce the human species, it seems only human in evolutionary terms to want to improve things for our own species by protecting the life-support systems on which we and every other species depend.

And that's where you begin to wonder just how much more insane things can get. As is now universally acknowledged, the sustainability of humankind (that is, our capacity for continuance as a species) depends on the sustainability of countless other species and on the relative stability of those life-support systems that sustain those species and maintain planetary balance. But imagine, for one surreal moment, that you were an alien sent down to Earth with a simple mission: to assess how to destabilize life on Earth as rapidly and comprehensively as possible with a view to getting rid of humankind and making Earth available for subsequent colonization by inhabitants of your own planet. Having read up on your thermodynamics and systems biology, and taken a careful look at what was going on, it wouldn't take you long to send back the following report to your eager Commander-in-Chief:

## Letter from An Alien

From: Playing Safe: Science and the Environment by Jonathan Porritt. Copyright © 2000. Johnathan Porritt. Reproduced by kind permission of Thames & Hudson Ltd., London.

Dear Boss,

Destabilizing life on Earth could be much easier than we thought.  
All we have to do is:

- 1 Persuade the human species to dig up and mine as much of the surface area of the Earth as possible, ostensibly to extract oil and gas, minerals, precious metals and so on, but in reality to spew back out into the atmosphere a substantial proportion of all those toxic elements it took 3.5 billion years to lock away safely in the crust of the Earth.
- 2 Persuade the human species to use its limited intelligence to manufacture as many synthetic compounds as possible which Nature has no way of absorbing or gradually breaking down. Persuade them that true happiness lies exclusively in the purchase of things made in this way, and that all the toxic waste gradually building up in Nature is a price worth paying for progress.
- 3 Persuade the human species to multiply at a rate over and above natural replacement (ie for each couple to have more than an average of 2.1 children), and to cover over as much as possible of the green surfaces of the Earth with houses, roads, factories, offices, recreation centres, Millennium Domes and so on, in the process undermining Nature's ability to put the order back into the thermodynamic mess these humans are creating.
- 4 Persuade the leaders of the human species that it makes a lot of sense for the rich to go on getting richer and the poor to go on getting poorer, and that there's no alternative to this anyway as that's what the religion of their so-called 'free market' dictates.

P.S. We won't need to marshal any invading force to put this war plan into action, as these very helpful human beings are already hard at work on all four action points without any encouragement from ourselves. Another few decades, and the job will be done.

Yours in Earth-bound obedience . . . .