Critical Thinking and the Environment

A Beginner's Guide for *Living in the Environment*

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2-6 PROBLEM SOLVING

Problem-Solving Techniques Here are some strategies you might find useful in trying to solve problems:

1. Develop a general strategy to:
   - Identify and clearly state the problem.
   - Collect, organize, and analyze information.
   - Generate, evaluate, and select among alternative solutions.
   - Develop a plan of action and a strategy to implement the plan.
   - Implement the plan and then evaluate the results.

   If necessary, modify your plan or develop a new one with a greater chance of success.
2. Make use of your right brain (Section 2-4) to help you ask relevant questions, define problems, and generate alternative solutions.
3. To prevent being overwhelmed by a big problem:
   - Minimize the problem: "No big deal. I can do this."
   - Break the problem down into smaller segments: Convert a seemingly insurmountable mountain into a series of small hills that you can more easily climb over.
4. To clarify the problem, respond several times orally and in writing to the following:
   - "I am dissatisfied with _____."
   - "The real problem is _____."
   - "What I *really* want to happen is _____." Imagine how you want things to be, and compare this to current reality.
5. Get help:
   - Consult the literature.
   - Talk with experts and others dealing with the same problem. The computer internet may be a good forum for accomplishing this.
6. Generate alternative solutions by:
   - Brainstorming
   - Working backward

- Reversing some or all assumptions and seeing where this leads
- Using analogies

7. For particularly frustrating problems that have reached a dead end:
   - Use your left brain to describe the problem, and then shift to your right brain.
   - Visualize the opposite of the situation. Reverse the objective.
   - Assume all of your information is wrong. Forget what you know.
   - Do something totally new. Expect the unexpected.
   - Analyze the problem from a different person's point of view.

Using Tree Diagrams One way to visualize a problem is a *tree diagram* (Figure 3). This approach is particularly useful for connecting causes of problems with proposed solutions. Such a diagram distinguishes between root and immediate causes, and between prevention and treatment solutions. The problem and its possible solutions are tied to underlying basic or grounding principles. (See the inside back cover of your textbook for a summary of such principles.)

Many environmental problems have overlapping root causes and solutions, especially prevention solutions. The implication is that some actions will help solve not just one but many problems. Indeed, one of the basic principles of environmental science is that everything is connected, and that because of these connections we cannot solve environmental problems in isolation. A tree diagram helps us see connections between underlying principles (the soil), causes (roots and base of the tree), and solutions (leaves on the deciduous tree). Some of the proposed solutions may not be workable or practical and, when reevaluated, can be shed like leaves falling from a deciduous tree.

Figure 4 is a tree diagram for the problem of potential global warming discussed in Chapter 12 of *Living in the Environment* and Chapter 10 of *Environmental Science*. In Chapter 3 of this booklet you will be asked to develop tree diagrams for various environmental problems.

Force-Field Analysis Defining a specific problem and planning action to solve the problem can be accomplished by using Kurt Lewin's

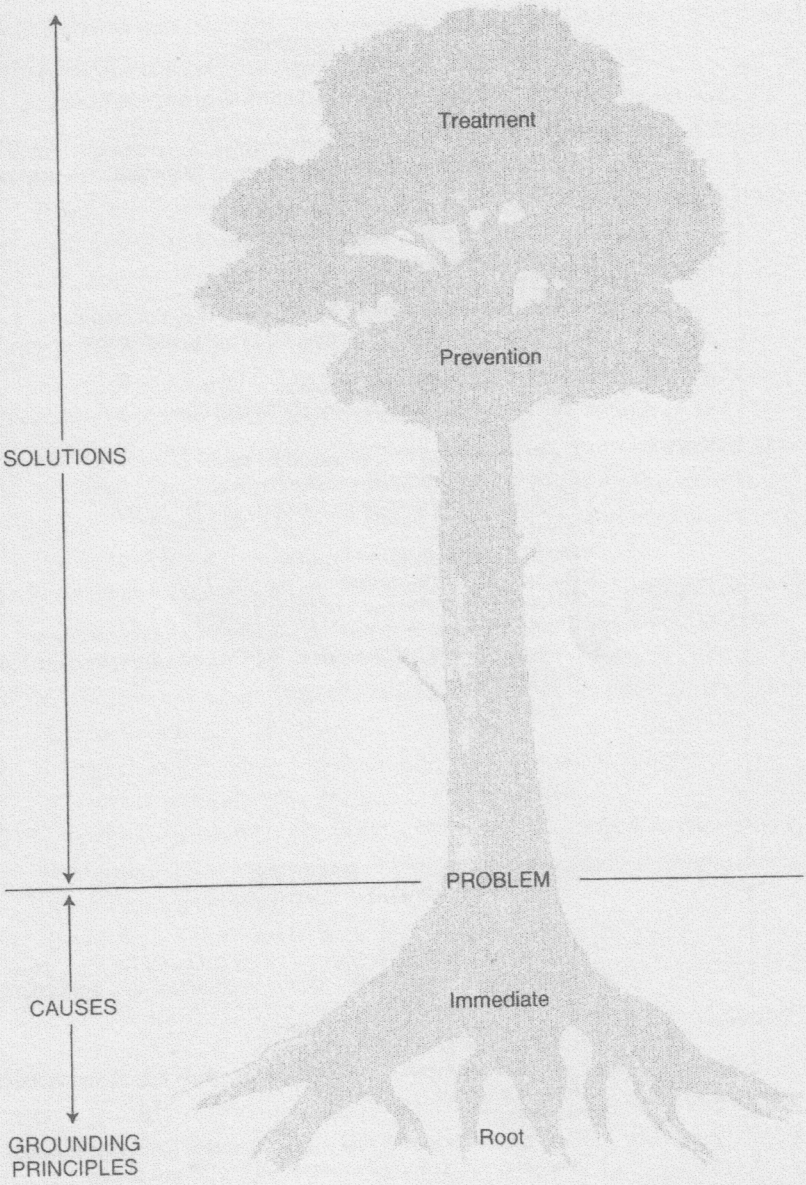

Figure 3 Tree diagram. The problem is defined at ground level. Causes are written at root level and divided into immediate and root causes. Solutions are at trunk and leaf level and divided into treatment and prevention solutions. A full understanding of the problem rests on the grounding principles at the basis of the diagram.

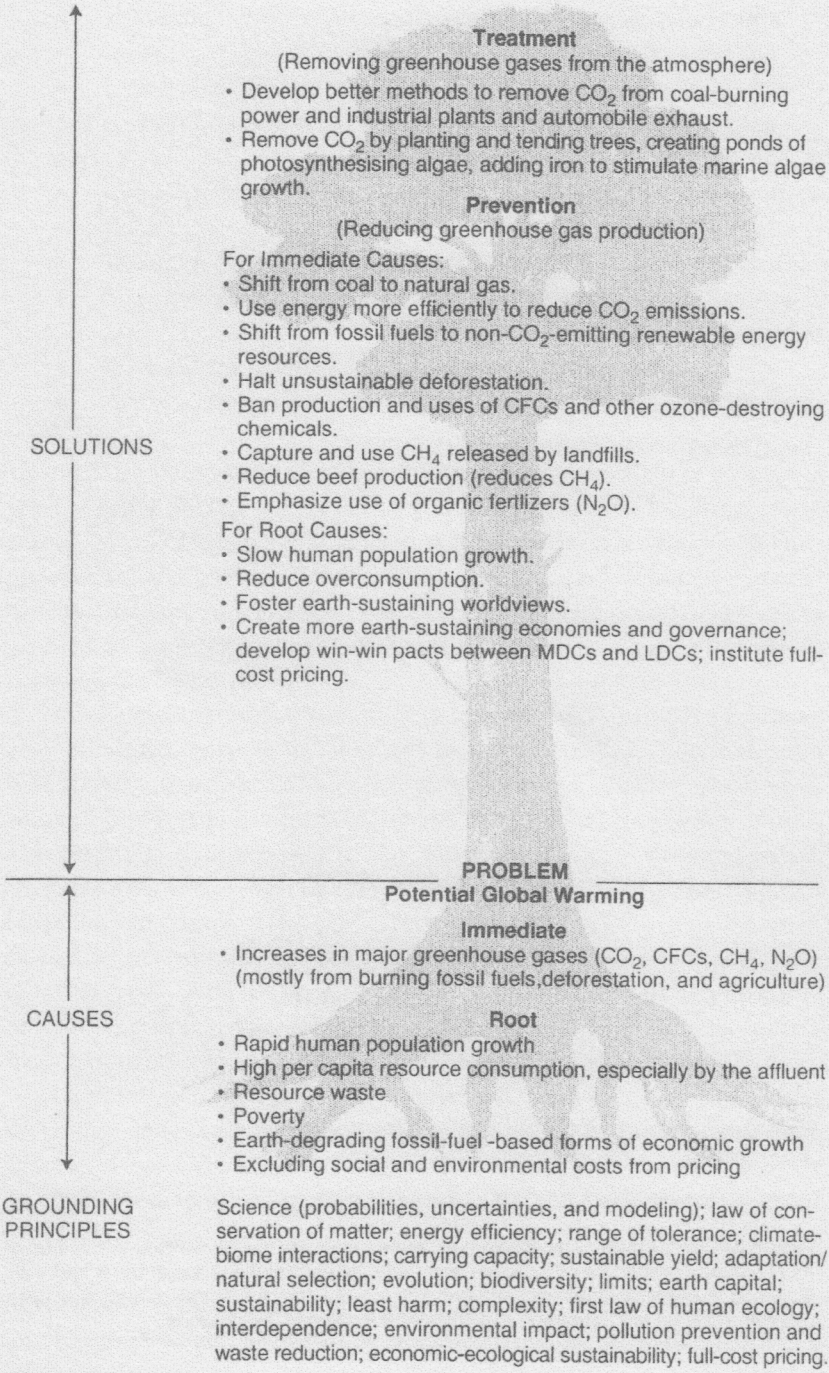

Figure 4 Tree diagram of potential global warming.

force-field analysis, described by Covey (1990) and Compton (1982) and summarized in Figure 5. It involves the following steps:

1. Identify the problem of interest; describe it in your own words or depict it with visual images. Use right-brain strategies to generate alternative statements of the problem.
2. Restate your problem in terms of the *current situation* (how it is) and the *ideal situation* (how you would like it to be).
3. List the *driving forces* that facilitate improvement in the situation and the *restraining forces* that resist improvement. Use brainstorming to help you identify these forces.
4. Evaluate and underline the driving and restraining forces that seem to be the most important. Then evaluate which of the strongest driving forces might be the easiest to encourage, and which of the strongest restraining forces might be the easiest to dampen. Using leverage at these points offers the best chance of achieving your desired solution to the problem.
5. For each force you have underlined, brainstorm some possible action steps you might implement to enhance the effect of driving forces or to reduce the effect of restraining forces.
6. Evaluate and underline the action steps that seem most effective and practical.
7. For each action step, list the materials, people, and other resources available for carrying out the action.
8. Use the information obtained in the previous steps to develop an integrated plan for solving the problem. Evaluate your plan and modify it as needed.
9. Develop a detailed strategy for implementing the plan.
10. Implement your plan, evaluate its effectiveness, and modify it as needed. Learn from your mistakes.

Group Action Research Force-field analysis may be used by individuals or groups. *Group action research* (Stapp, et. al., 1988) deliberately focuses on a group of people working toward the resolution of a problem by generating knowledge, developing a plan, taking action, evaluating the results, and using this knowledge to make improvements.

The process begins when a group of people decide to address problems that affect them. They identify a range of problems and then explore, discuss, negotiate, and isolate one problem for study. Then they work together to develop possibilities for resolving the

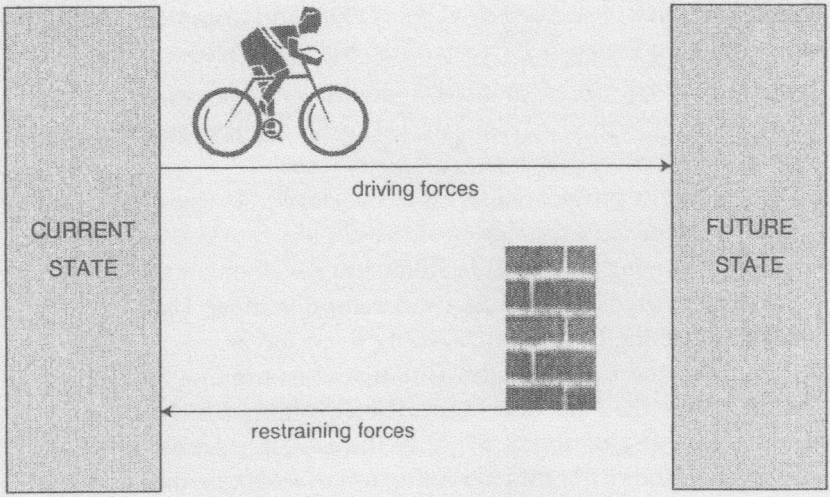

Figure 5 Force-field analysis. A problem is defined in terms of how things currently are and how you want things to be in the future. Driving forces (bicycle) work for change, whereas restraining forces (brick walls) maintain the status quo or pull events back to an earlier state. Driving forces must scale or drill through defenses and exert damage control. The vision of the future is strongly imbedded in a values system.

problem. As members of the group begin to generate ideas, they enter the first loop of a spiral (Figure 6). They develop a first plan (P_1) that will help them solve their problem, implement that plan (I_1) and then evaluate its effectiveness (E_1). Evaluation of the plan leads to the development of another plan, which takes them into the second loop in the spiral of planning, implementation, and evaluation based on a continuing feedback of knowledge. Each feedback loop generates additional loops, until the problem is resolved to the satisfaction of the participants. Idea generation (characterized by brainstorming, creating, exploring, and imagining) and idea analysis (characterized by reflecting, analyzing, discussing, and negotiating) continually feed into the process. In addition, as the project evolves, participants continually reflect upon their learning. By doing this, they can incorporate or feedback new information to increase the chances of success or to adjust their plan to changing circumstances.

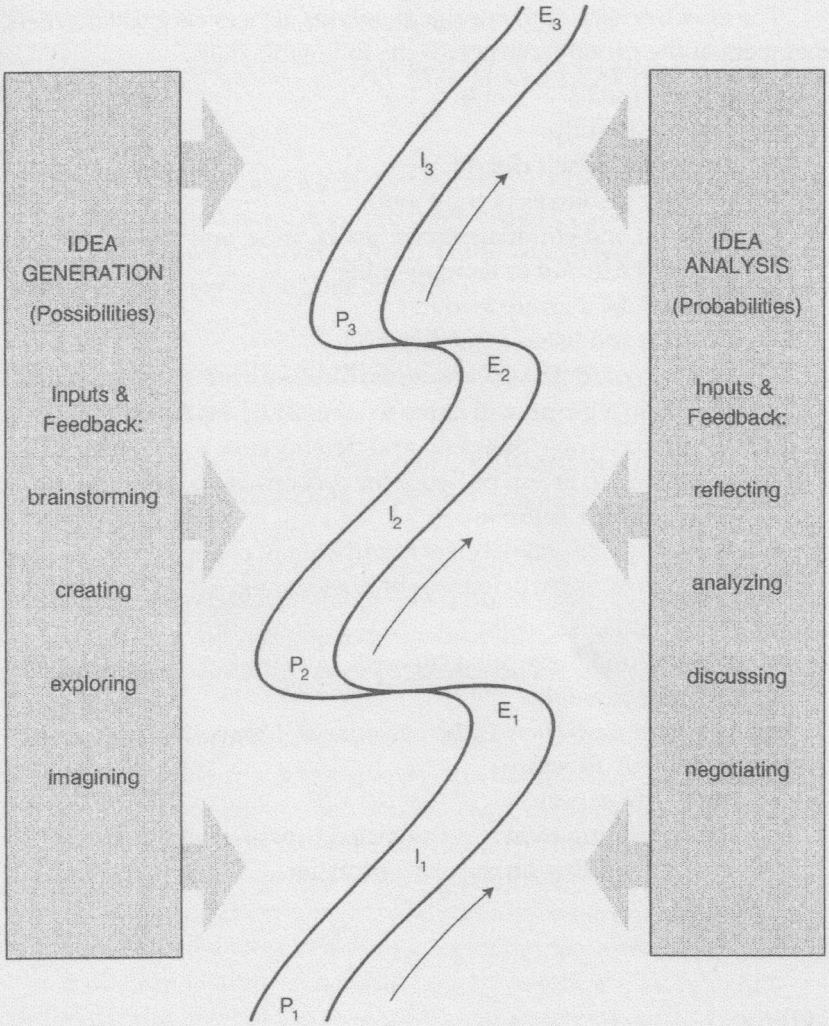

Figure 6 Group action research approach for problem solving. The process starts when a group comes together and focuses on a common problem. They create a plan (P_1), implement the plan (I_1), and evaluate the results (E_1). From their experiences and changing circumstances, they are ready to start the next loop of the spiral (P_2) and continue the process until they consider the problem to have been satisfactorily addressed. Idea generation (brainstorming, creating, exploring, and imagining) and idea analysis (reflecting, analysing, discussing, and negotiating) feed in throughout the process. (Modified from Stapp, et al., 1988.)

The effectiveness of the problem-solving process is greater when members of the group have honed the following skills:

Group process skills

- Listen carefully.
- Express yourself clearly.
- Identify resources of the group.
- Talk out and eliminate racist, sexist, agist, and classist biases.
- Work as a group or team member.
- If asked, be a group leader.
- Provide and listen to feedback.
- Work toward group consensus, but be aware that sometimes people in a group will agree to something that they believe is stupid or wrong. Stand up and defend your beliefs instead of bowing to group pressure for consensus because you are tired or want approval.
- Work together (synergize) to implement change.
- Learn how to participate in brainstorming.

Information gathering skills

- Prepare and carry out a survey.
- Interview people.
- Use resources such as the newspaper, library, internet, and telephone directory.
- Talk with experts.
- Gather information from agencies, organizations, and groups working on the same problem.