

Chapter 01

Lecture Outline*

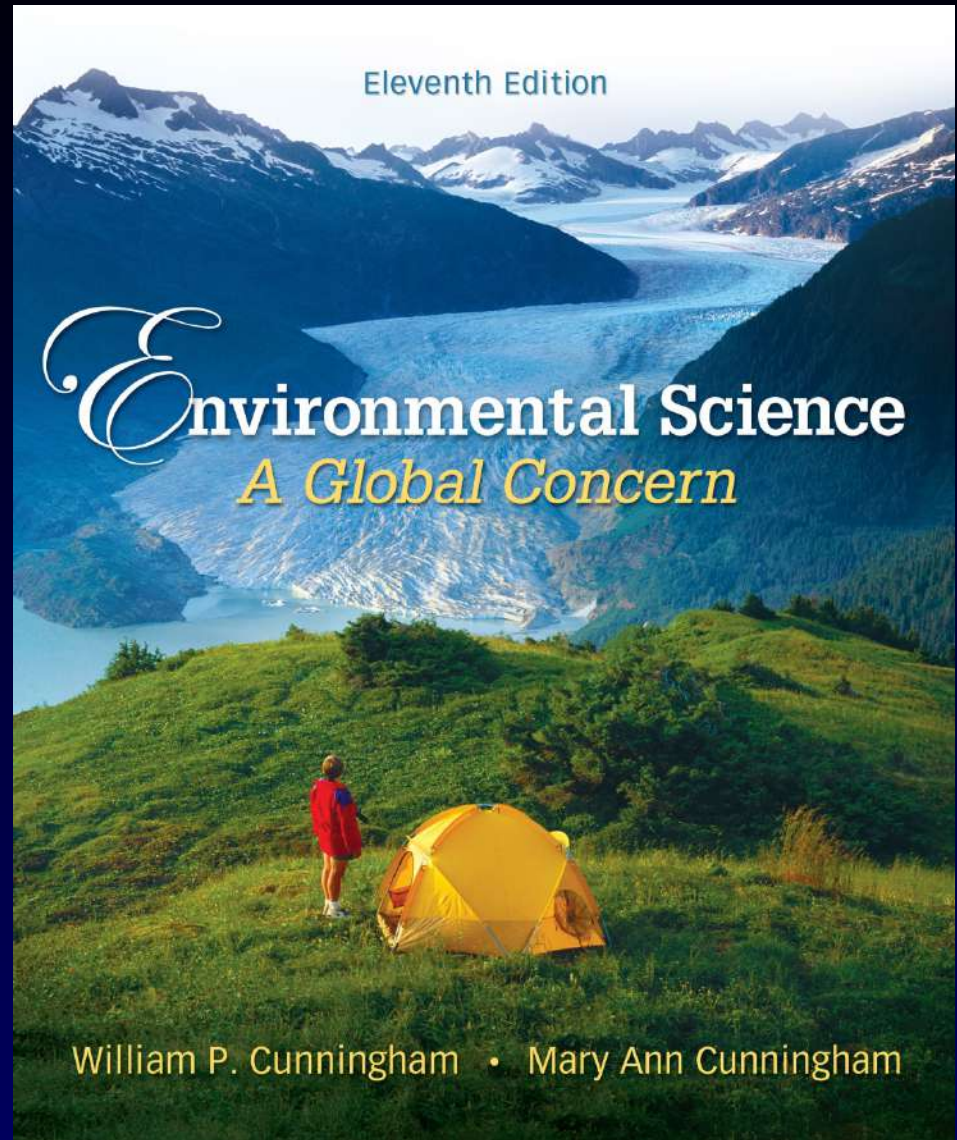
William P. Cunningham

University of Minnesota

Mary Ann Cunningham

Vassar College

***See PowerPoint Image Slides for all figures and tables pre-inserted into PowerPoint without notes.**



Understanding our Environment

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



© China Photos/Getty Images

Outline

- Introduction
- Current Conditions
- Historical Perspectives
- A Divided World
- Sustainable Development
- Indigenous People
- Environmental Ethics
- Environmental Justice
- Environmental Racism

Introduction

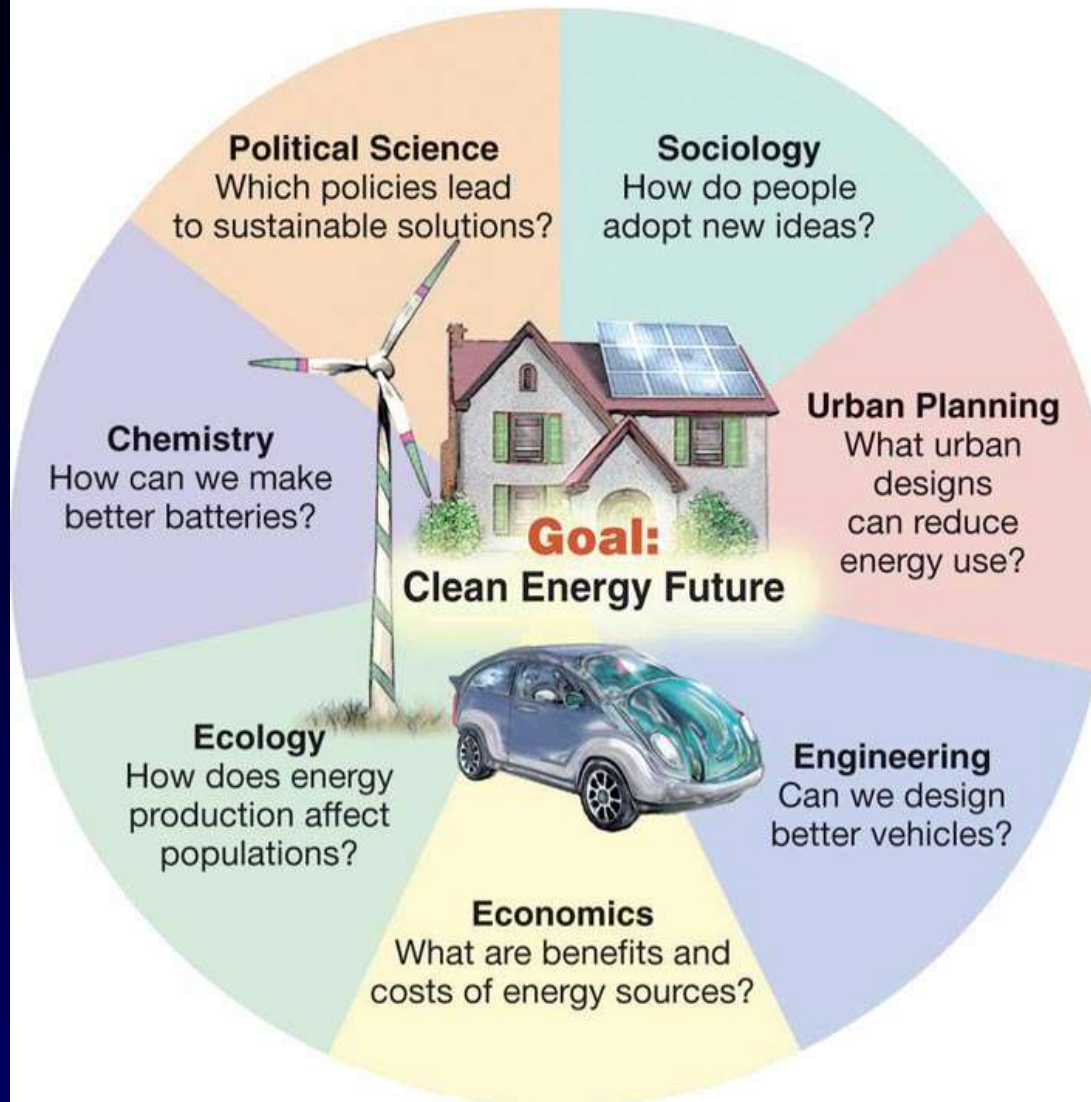
- Humans have always inhabited both the natural world and the social world.
- **Environment:**
 - ❖ Circumstances or conditions that surround an organism or groups of organisms
 - ❖ The complex of social or cultural conditions that affect an individual or community

Introduction

- **Environmental Science:** Systematic study of our environment and our proper place in it
 - ❖ Interdisciplinary
 - ❖ Integrative
 - Natural Science
 - Social Science
 - Humanities
 - ❖ Mission oriented

Knowledge Which Contributes to the Understanding of Environmental Science

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

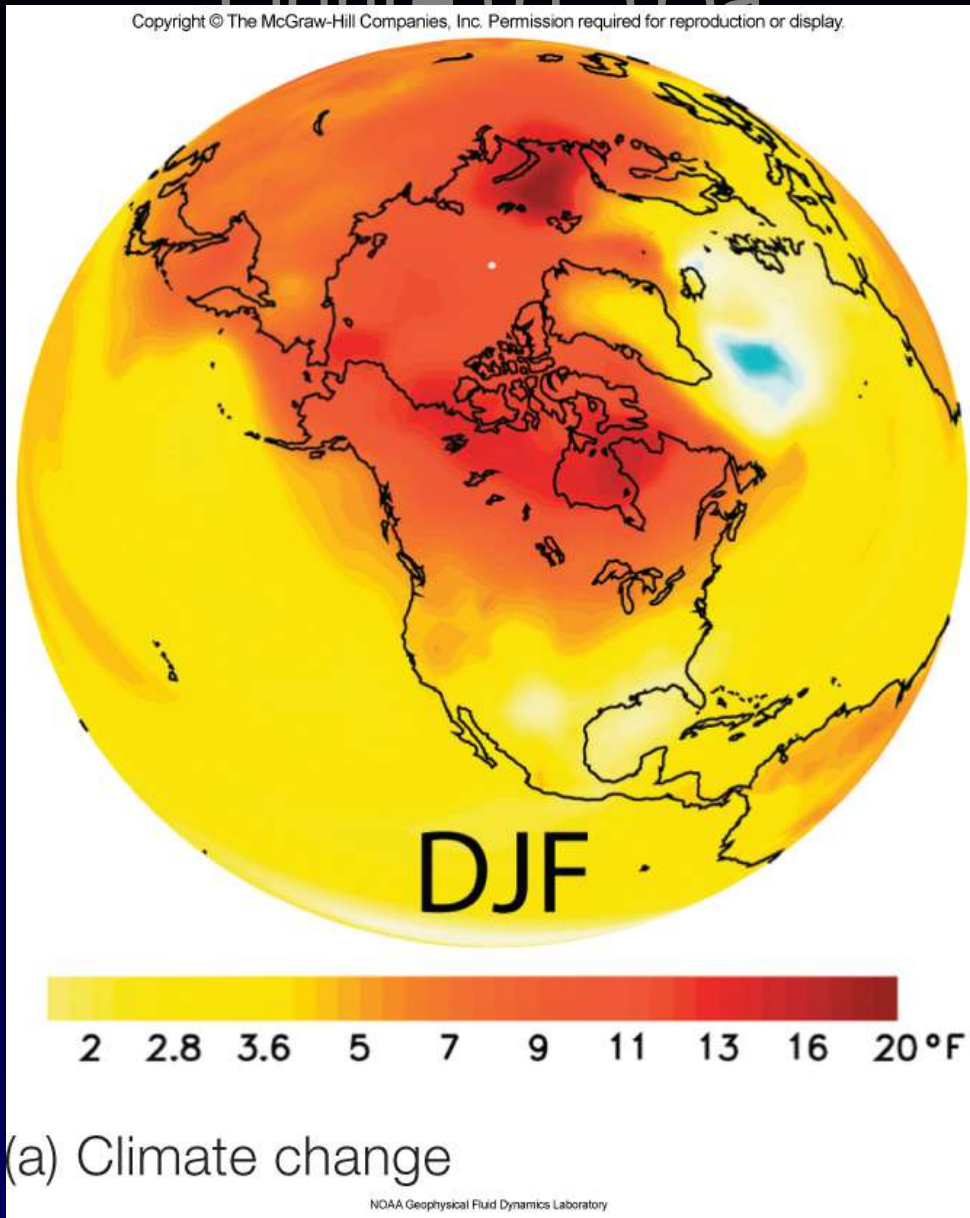


Current Conditions

- **Human Population > 7.2 Billion**
 - ❖ **Water:** water quantity and quality issues may be the most critical issues in the 21st century.
 - ❖ **Food:** food is inequitably distributed across the globe and 2/3 of agricultural lands show signs of degradation.
 - ❖ **Climate Change & Energy:** burning fossil fuels causes global climate change and fossil fuel reserves are diminishing.
 - ❖ **Air Pollution:** air quality has worsened in many areas, especially southern Asia and India.
 - ❖ **Biodiversity:** species are being lost at a rapid rate

Figure 01_05a

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



(a) Climate change

NOAA Geophysical Fluid Dynamics Laboratory

Signs of Hope

- Progress has been made on many fronts.
 - ❖ **Population Stabilization:** Human birth rates have stabilized in most industrialized countries.
 - ❖ **Health:** Incidence of life-threatening diseases has been reduced in most countries.
 - ❖ **Habitat Conservation:** Deforestation has slowed & habitat protection has improved in some areas.
 - ❖ **Renewable Energy:** Progress is being made in the transition to renewable energy sources.
 - ❖ **Freedom:** Democracy is spreading around the world allowing local people to govern themselves.
 - ❖ **International Cooperation:** helps solve global environmental problems

Historical Perspective

- Four Distinct Stages

- ❖ Pragmatic Resource Conservation
- ❖ Moral and Aesthetic Nature Preservation
- ❖ Concern about Health and Ecological Damage
- ❖ Global Environmental Citizenship

These stages are not mutually exclusive; parts of each persist today in the environmental movement.

Pragmatic Resource Conservation

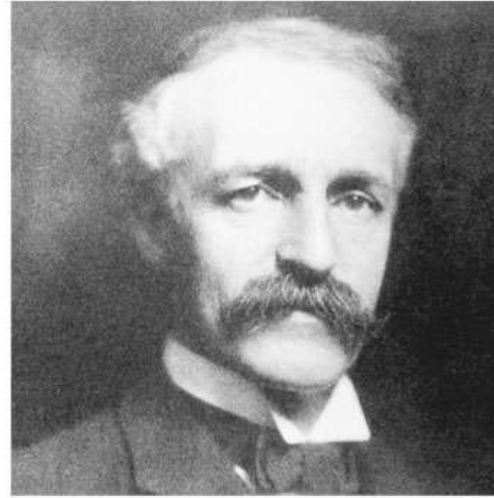
- George Perkins Marsh - *Man and Nature* published in 1864
 - Influenced Theodore Roosevelt and his conservation advisor, Gifford Pinchot
 - Pragmatic Utilitarian Conservation
 - “Greatest good for the greatest number for the longest time”
 - Multiple Use Policies of USFS

Ethical and Aesthetic Nature Preservation

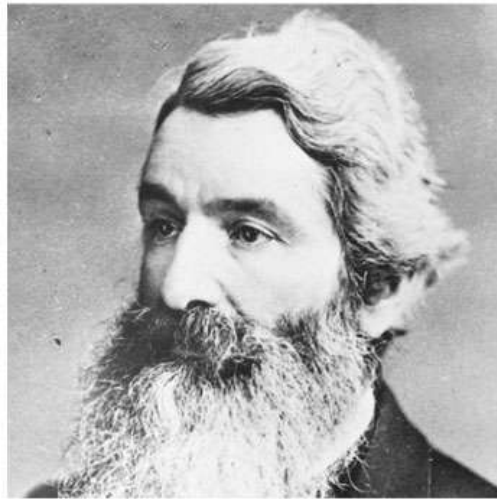
- **John Muir** - President Sierra Club
 - ❖ Nature deserves to exist for its own sake - regardless of degree of usefulness to humans. (*Biocentric Preservation*)
 - ❖ “The world, we are told, was made for man. A presumption that is totally unsupported by the facts...Nature’s object in making animals and plants might possibly be first of all the happiness of each one of them...Why ought man to value himself as more than an infinitely small unit of the one great unit of creation?”



(a) President Teddy Roosevelt
Courtesy of the Bancroft Library, University of
California, Berkeley



(b) Gifford Pinchot
Courtesy of Grey Towers National Historic
Landmark



(c) John Muir
© Bettmann/Corbis

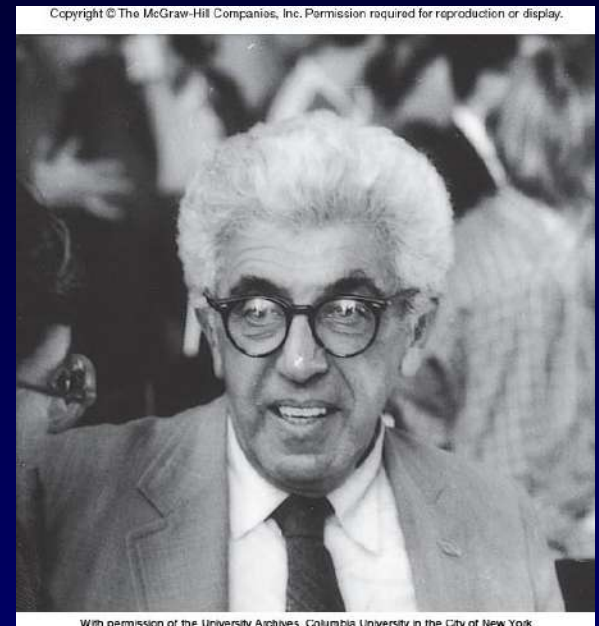
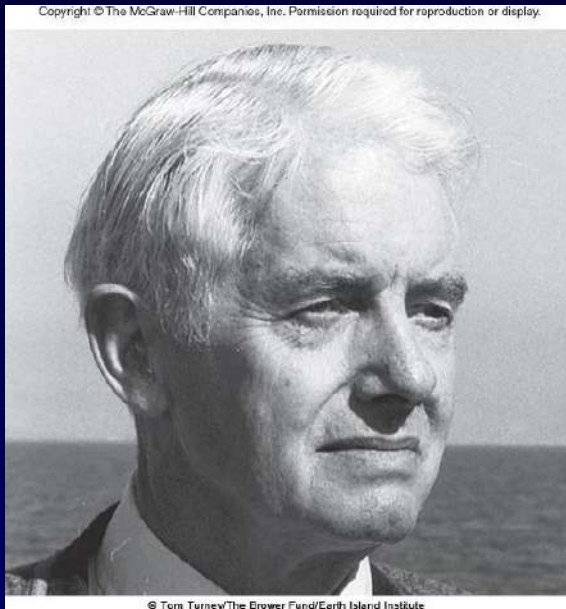


(d) Aldo Leopold
© AP/Wide World Photos

Modern Environmental Movement

- The industrial expansion after WW II added new concerns to the environmental agenda.
 - ❖ Rachel Carson – awakened the public to the environmental threat posed by pesticides in her book *Silent Spring* (1962)
 - ❖ David Brower—introduced the use of litigation, regulatory intervention, and the use of mass media to environmental activists.
 - ❖ Barry Commoner—an activist scientist who spoke out about environmental hazards.

Modern Environmental Leaders



Global Environmentalism

- Modern media now allow for increased international communications. Local and regional environmental leaders increasingly have a worldwide impact.

Global Environmental Leaders:

- Wangari Maathai--Kenya
- Yu Xiaogang—China
- Muhammad Yunus—India
- Gro Brundtland--Norway



A Divided World

- World Bank estimates more than 1.4 billion people live in extreme poverty earning < \$1 (U.S.) per day.
- Poor are often both victims and agents of environmental degradation. They are trying to meet their present survival needs at the cost of long term sustainability.
- Cycle of poverty continues over generations as people who are malnourished and ill cannot work productively and raise healthy children.

A Divided World

- About 1/5 of the world's population lives in countries with per capita income > \$25,000 per year (U.S.). The other 4/5 lives in middle or low income countries.
- Gap between rich and poor continues to increase.
- The gap affects many quality of life indicators.



Quality of Life Indicators

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

TABLE 1.1

Quality of Life Indicators

	Least-Developed Countries	Most-Developed Countries
GDP/Person ¹	(U.S.)\$329	(U.S.)\$30,589
Poverty Index ²	78.1%	~0
Life Expectancy	43.6 years	76.5 years
Adult Literacy	58%	99%
Female Secondary Education	11%	95%
Total Fertility ³	5.0	1.7
Infant Mortality ⁴	97	5
Improved Sanitation	23%	100%
Improved Water	61%	100%
CO ² /capita ⁵	0.2 tons	13 tons

¹Annual gross domestic product

²Percent living on less than (U.S.)\$2/day

³Average births/woman

⁴Per 1,000 live births

⁵Metric tons/yr/person

Source: UNDP Human Development Index, 2006.

Is There Enough for Everyone?

- Rich nations consume an inordinate share of the world's resources and produce an unsustainable amount of pollution.
- The U.S. makes up 4.6% of the world's population, but consumes 25% of all oil production and generates 50% of all toxic wastes in the world.
- If all the residents of China were to match American consumption, it would take four extra planet Earths to support them using current technology.

Economic Progress

- Over the past 50 years, the world's Gross Domestic Product (GDP) increased from \$2 trillion to \$22 trillion.
- Since WW II, average real income in developing countries has doubled and life expectancy has increased by 30%.

BUT

- The worldwide gap between rich and poor has widened.

Sustainable Development

- “Meeting the needs of the present without compromising the ability of future generations to meet their own needs.”
 - ❖ Benefits must be available to all humans, rather than to a privileged few.
 - ❖ Economic growth alone is not enough. Political stability, democracy, and equitable economic distribution are needed to ensure that all benefit.

Sustainable Development

Many ecologists view continual growth as impossible in the long run due to limits imposed by non-renewable resources and the capacity of the biosphere to absorb wastes. Others argue that through the use of technology and social organization, we can manage to meet our needs and provide long-term (but not infinite) growth.

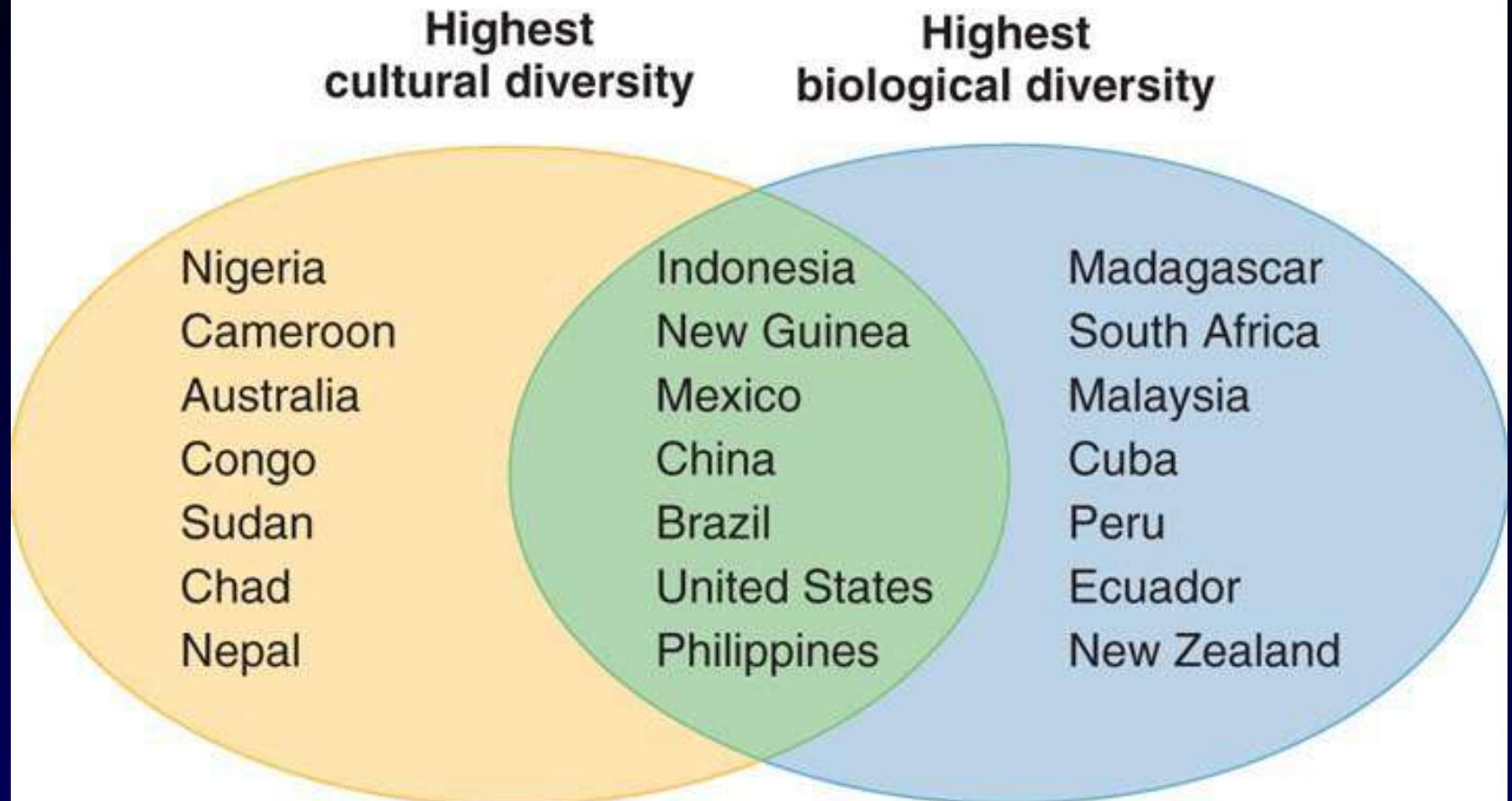
Indigenous People

- Indigenous (native) people are often the least powerful, most neglected people in the world.
 - ❖ At least half the world's 6,000 distinct languages are dying.
 - ❖ Indigenous homelands may harbor vast percentage of world's biodiversity.
 - ❖ Recognizing native land rights and political rights may often be a solid ecological safeguard as indigenous people have a rich knowledge of local habitats.



Biological and Cultural Diversity are Linked

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



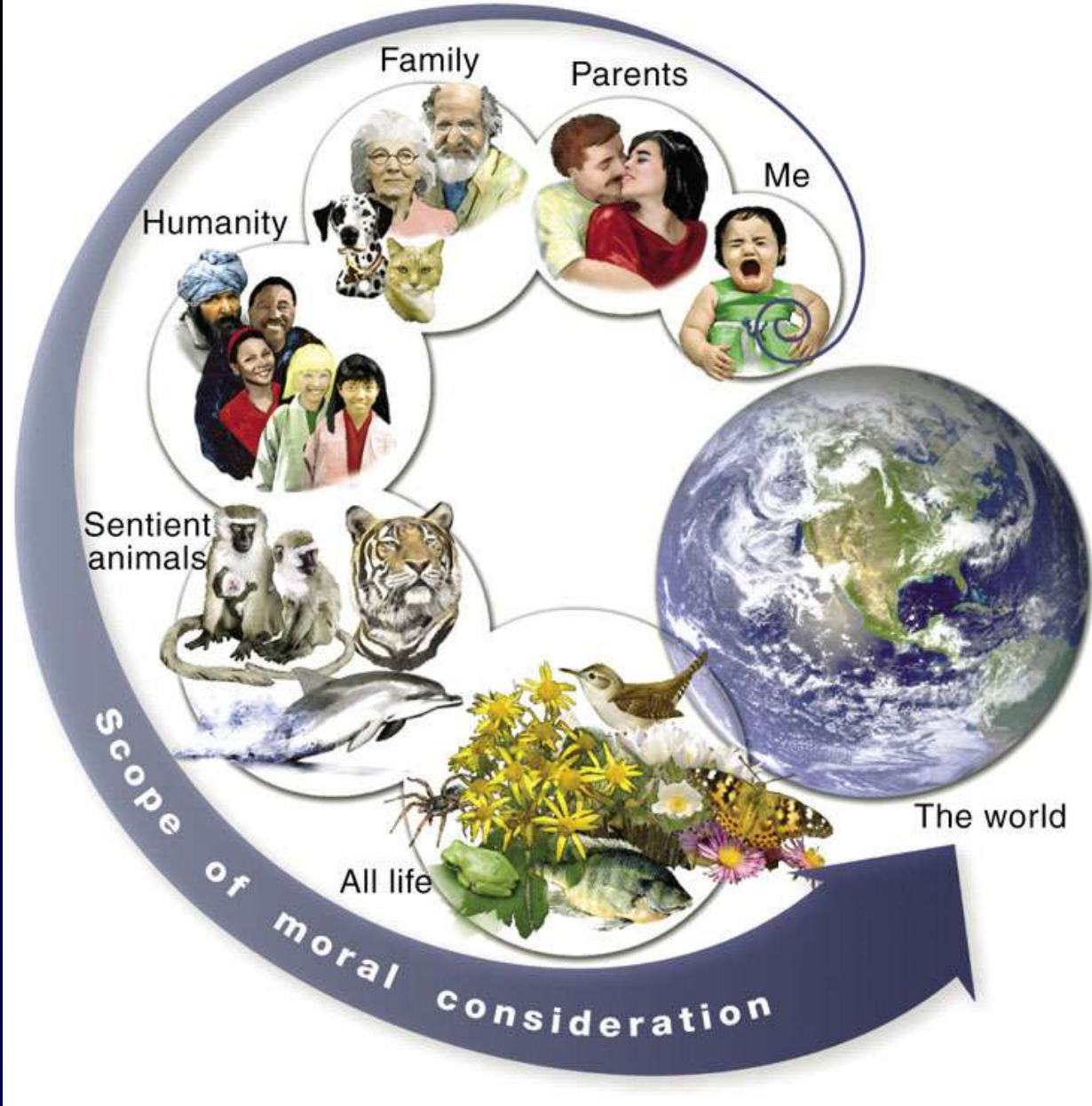
Source: Norman Myers, Conservation International and Cultural Survival Inc., 2002

Environmental Ethics & World Views

- **Ethics** is a branch of philosophy concerned with what actions are right and wrong.
- **Environmental ethics** deals with our moral obligations to the world around us.
- **Worldviews** - sets of basic beliefs, images and understandings that shape how we see the world around us. Worldviews also determine what questions are valid to ask.
- *How we relate to the environment depends largely on our values and world view.*

Who or What has Moral Value?

- **Moral extensionism** - extending moral values to others
 - ❖ Should moral extensionism include granting some degree of moral value to animals, plants and the environment?
- **Value** - a measure of the worth of something
 - ❖ Inherent value - intrinsic or innate worth
 - ❖ Instrumental value - items have worth only because they are valued by another person



Religious Traditions

Ethical and moral values are often rooted in religious traditions.

Stewardship - taking care of the resources we are given.

Calls for both environmental stewardship *and* human domination over nature can be found in most world religions.

Increasingly, many churches and religious leaders today are promoting faith based environmental stewardship and conservation.

Environmental Justice

Because of their economic status, minorities in the US and globally may be subjected to a disproportionate amount of environmental health risks in their neighborhoods and work places.

The field of *environmental justice* combines civil rights with environmental protection to demand a safe and healthy environment for everyone.



© Sam Kittner

Environmental Racism

Environmental Racism is an inequitable distribution of environmental hazards based on race.

Lead poisoning in children from drinking water from aging plumbing or eating paint chips in older buildings is an example of this phenomenon.

At all income levels, black children are 2 to 3 times more likely suffer lead poisoning in the US than are white children.

Toxic colonialism

- **Toxic colonialism** is the practice of targeting poor communities or communities of color in developing nations as waste disposal areas.
- For example, Native Americans have been subject to numerous attempts to set up hazardous waste sites, landfills or incinerators on their reservations.

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.



© William P. Cunningham

Science As a Way of Knowing

- Scientists collaborate in a cumulative, self-correcting process.
 - ❖ Many people often work on many different aspects of a problem.
- Creativity, insight, aesthetics and even luck play important roles in scientific research.



TABLE 1.1 Some Scientific Assumptions

1. The world is knowable. With careful, impartial observation and logical analysis, we can make sense of the fundamental processes and laws that shape our environment.
2. Basic patterns that describe events in the natural world are uniform throughout time and space. The forces at work now are the same as those that shaped the world in the past and will continue to do so in the future.
3. Where two equally plausible explanations for a phenomenon are possible, we should choose the simpler one. (Also known as the law of **parsimony**, or Ockham's razor after the English philosopher who first proposed this rule.)
4. Change in knowledge is inevitable because new evidence may challenge prevailing theories. No matter how well one theory explains a set of observations, it is possible that another theory may fit just as well or better, or may fit a still wider range of data.
5. Although new facts can disprove existing theories, science can never provide absolute proof that a theory is correct. Every theory should be considered only conditionally or provisionally correct until contrary evidence is found.
6. Even if there is no way to secure complete and absolute truth, increasingly accurate approximations can be made to account for the world and how it works.
7. Because science provides information about both mechanisms and processes in the world around us, it can help find practical solutions for many problems.

Scientific Design

- **Reproducibility**

- ❖ Experiments must be designed and recorded such that they can be exactly reproduced by other researchers.

- **Controlled Studies**

- ❖ Comparisons are made between experimental and control populations.

- Every factor except the one being studied is held constant.

Scientific Design

- **Blind Experiment**

- ❖ Conducted so investigators do not know which is the control and which is the experimental group, until after data have been gathered and analyzed.

- **Double-Blind**

- ❖ Neither the subject nor the investigators know which participants are receiving an experimental treatment.

Reasoning

- **Deductive**

- ❖ Starting with a general principle and deriving a testable predication about a specific case.

- **Inductive**

- ❖ Specific examples are examined to locate patterns and derive general explanations from collected observations.

Hypotheses and Theories

- Hypothesis

- ❖ Conditional explanation that can be tested by further observation or experiment.

- Logically, a hypothesis based on inductive reasoning can be shown to be wrong, but can almost never be shown to be unquestionably true.

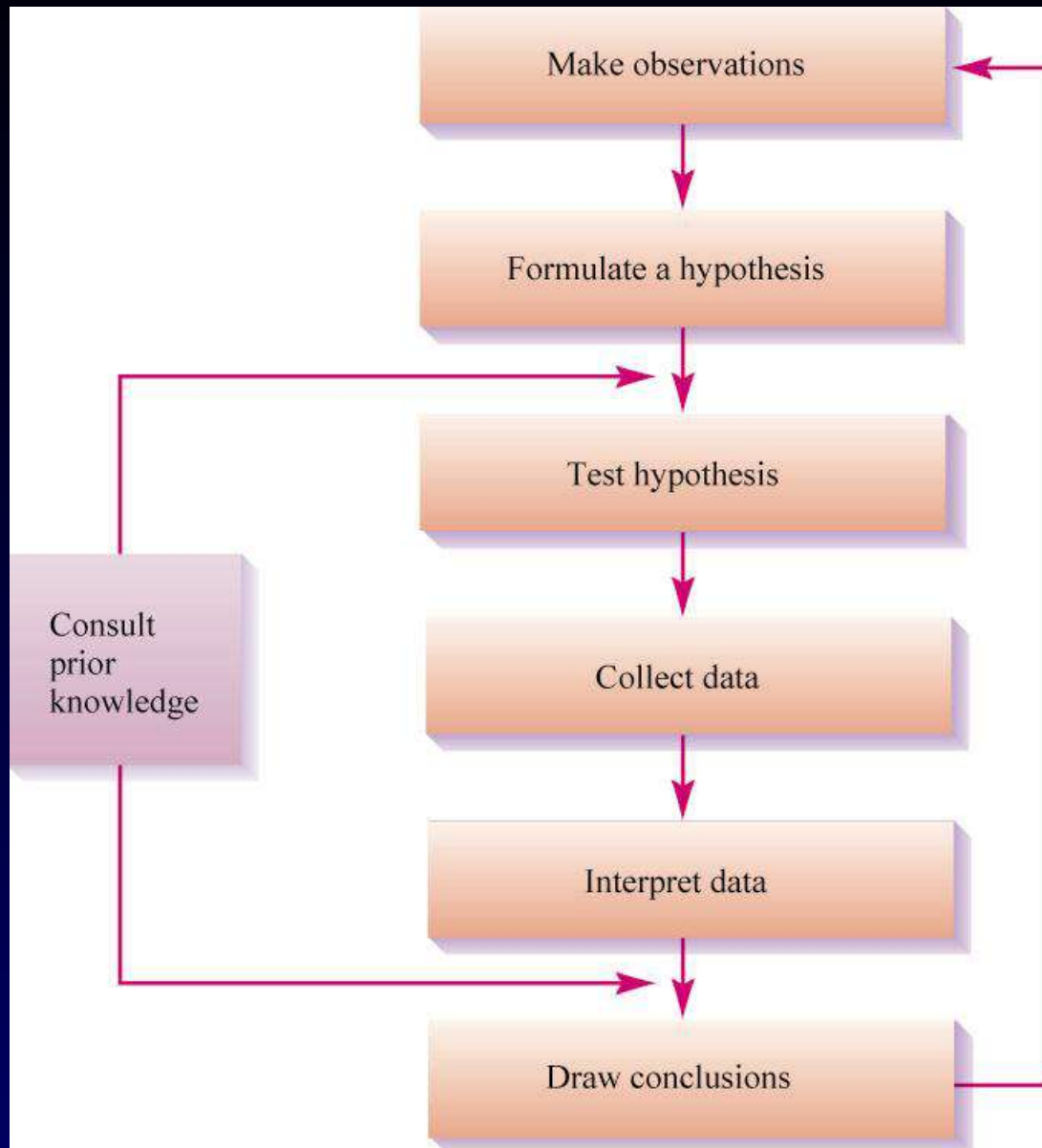
- Evidence is always provisional.

- Scientific Theory

Scientific Theory

- When a large number of tests supports an explanation and a majority of experts in a given field have reached a general consensus that it is the best description or explanation available, we call it a scientific theory.

Scientific Method



Paradigms and Scientific Consensus

- **Paradigms**

- ❖ Overarching model of the world that guides our interpretations of events.

- Tend to guide the types of questions asked by investigators.

- ❖ **Paradigm shifts** occur when a majority of scientists agree the older general explanations no longer fit the observations.

Approaches to Knowledge and Thinking

- **Analytical Thinking**
 - ❖ How can I break this problem into parts ?
- **Creative Thinking**
 - ❖ How can I approach this differently ?
- **Logical Thinking**
 - ❖ How can deductive reasoning help ?
- **Critical Thinking**
 - ❖ What am I trying to do ?
- **Reflective Thinking**
 - ❖ What does it all mean ?

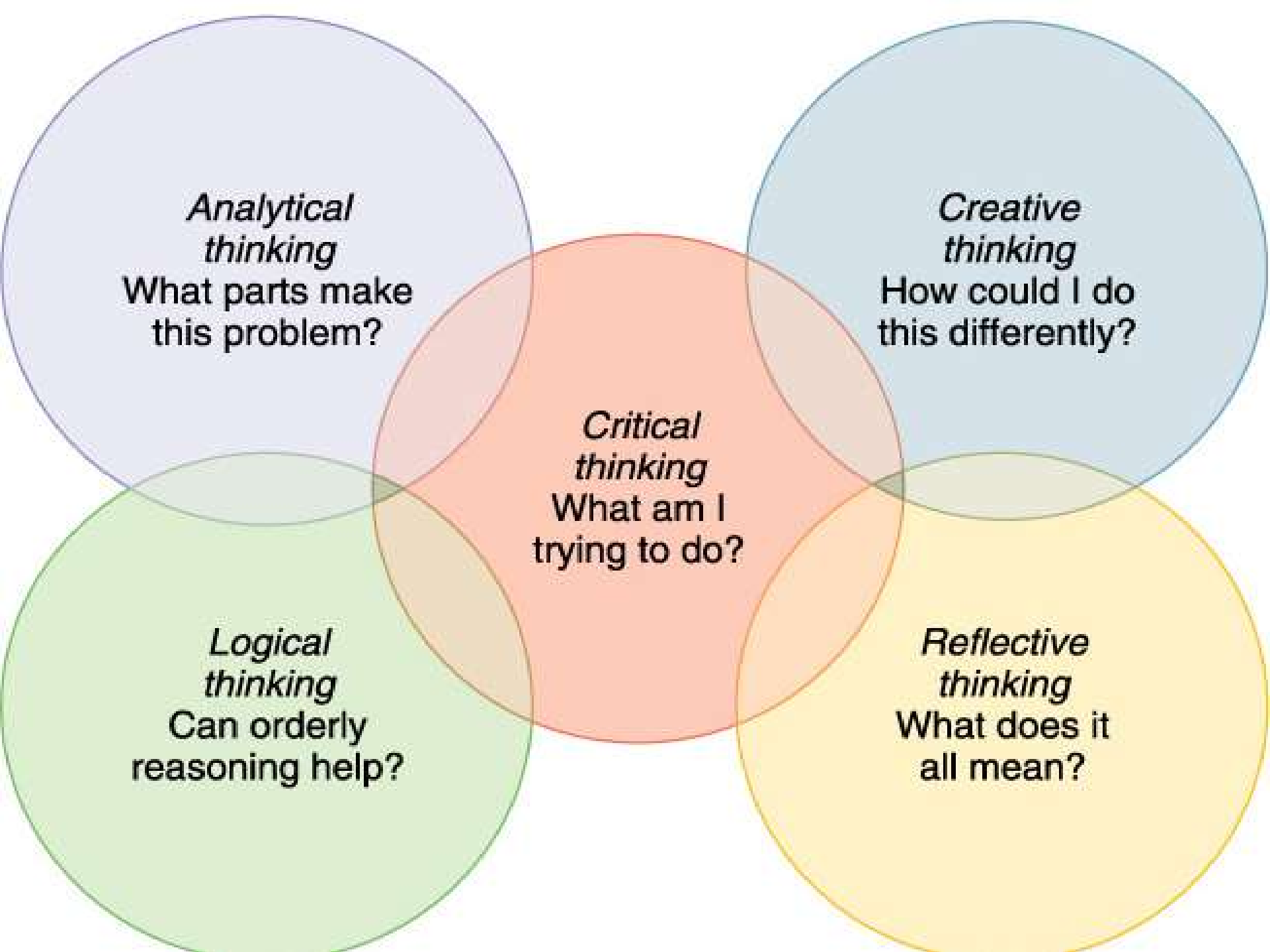




Table 1.3 TABLE 1.3 Steps in Critical Thinking

1. What is the purpose of my thinking?
2. What precise question am I trying to answer?
3. Within what point of view am I thinking?
4. What information am I using?
5. How am I interpreting that information?
6. What concepts or ideas are central to my thinking?
7. What conclusions am I aiming toward?
8. What am I taking for granted; what assumptions am I making?
9. If I accept the conclusions, what are the implications?
10. What would the consequences be, if I put my thoughts into action?

Steps in Critical Thinking

- Identify and evaluate premises and conclusions in an argument.
- Acknowledge and clarify uncertainties, vagueness, equivocation, and contradictions.
- Distinguish between facts and values.
- Recognize and assess assumptions.
- Distinguish source reliability or unreliability.
- Recognize and understand conceptual frameworks.