# ENVIRONMENTAL STUDIES 197
# SENIOR THESIS
# GUIDELINES

# REVISED AND UPDATED 2008

# CHAPTER 1

# INTRODUCTION: WHAT IS A THESIS IN ENVIRONMENTAL STUDIES?

The senior thesis in Environmental Studies is probably different from other work you have done during your college career. It is a substantial research project in which you will focus on a specific and limited problem the knowledge you have gained from a wide range of disciplines. You are *encouraged* to do appropriate original research (such as field observations, analysis of printed sources, interviews, or controlled simple experimentation); you are *expected* to draw upon appropriate resources in the library. An acceptable thesis will have these six characteristics: as research, it is driven by questions, it is original, it is public, it is substantial, it is shaped through interaction with an advisor, and it is scholarly.

**1. As research, the thesis is driven by questions**. Research is a search for knowledge and understanding of a defined topic. Students often come to believe that research means collecting a lot of information about a topic and patching it together like a monstrous book report. *This is a myth!* Research is *not* simply a collection of data; instead, it is an attempt to answer a question or a set of questions. The information you need to collect is whatever will allow you to answer the questions you have—so your questions are critical; they drive the whole research process.

This doesn't mean that the questions you start with are necessarily the questions you end up answering. You may find that you need to expand or (more often) narrow your questions; the process of research itself may lead you to new questions that you couldn't have asked before you began but come to see as more important than your original questions. If your questions change, don't be alarmed; that's normal.

Where do these questions lead a thesis researcher in environmental studies? Driven by questions about an environmental issue or problem, you will collect or generate data, you will analyze the data and draw conclusions. For most theses, answering your questions will mean making recommendations. For example, a thesis on the Channel Islands did not simply present bundles of interesting facts about the islands; instead, it analyzed those facts to determine the impacts of visitors to the islands, in order to recommend an appropriate policy for regulating those visitors. Another thesis on bicycling as an alternate form of transportation asked "What rules should be developed to reduce bicycle accidents?" The author developed a data base about bicycle accidents and their causes, developed and tested a hypothesis, drew conclusions and recommended a set of policies.

**2. The thesis is original**. Even if you are not conducting field research, even if you are working solely with printed sources written by others, there is an important sense in which your thesis is an original work. Even if all you are doing is synthesizing materials, the questions you ask of your sources and the purposes for which you draw on them allow you to write something that is original and creative. Perhaps you are applying a hypothesis to a set of data that has not been tested against that hypothesis; perhaps you are analyzing a body of information from a particular value framework or with a set of policy alternatives in mind. In any case, the thesis is *your* work, driven by your questions; *don't be afraid to think originally*.

**3. The thesis is public**. Unlike most papers you have written, the thesis is not something that passes only between you and your TA or instructor, perhaps also being shown to a friend for editing or a parent if you do well on it. The finished thesis is a public document, kept on file by the Environmental Studies Program for at least five years; selected theses will also be placed on reserve in the Reserve Book Room for future generations of students to use. The public aspect of the thesis has these implications:

a) Your thesis should be written to be read. This may sound obvious, but keep thinking about it. Readers approach research documents like your thesis not to be entertained, but because they need something from it. The decisions you make about what information to include, how to organize it, how to format it, what connections to make or conclusions to draw—all of these decisions should be made with the idea that readers will be trying to understand and use what you have written.

b) Different readers have different needs, and therefore will use different parts of your thesis. It's a good guess that 80% of the readers of a technical document like yours will read only 20% of what you write—but not necessarily the same 20%. Therefore it's crucial that you present your material in ways that allow each reader to get what she or he needs from it. For some of the decisions you will face—about format and organization, about using figures and documenting sources, for instance—this manual prescribes a way to do it. Our reason for these rules is the same as for the rules in any academic journal or in writing an Environmental Impact Report: to set up a system that makes it easy for different readers to get access to the part of what you know that they need. For all the decisions you face in your writing that this manual does not address, follow the same principle: make it easy for readers to access whatever kind of information or degree of complexity they need.

c) This thesis will demonstrate your abilities and those of the Environmental Studies Program. If you cut corners on this work, it will show to whoever reads the thesis. This may be an encouragement to start early, to budget more than enough time to carry through each stage of the work, and to seek out help when you get stuck.

**4. The thesis is substantial**. The scale of this project makes it qualitatively different from shorter papers you may have done before. A paper perhaps 30-40 pages in length is *not* the same thing as three or four 10-page papers stacked on top of each other. You must select an issue that is large enough to be significant; you must *focus* it in a way that makes it small enough to manage. You must formulate research questions, decide on data-gathering strategies, collect and analyze information, draft and revise your final document—all serious, substantial intellectual tasks that must be managed in the real world, with available resources, completed on time by a set deadline.

How long should the thesis be? The best answer is as long as your topic warrants. However, that answer doesn't provide much help when you're trying to decide on the intellectual boundaries to the project—the scope and the level of detail your treatment will require—and on the time and energy you will need to commit. A good goal to aim for is a document of 30-40 pages of text, plus tables and figures, references, and appendices. That's 30-40 pages of lean, focused writing, without padding; if you tend to write more fluidly and effusively, aim for a longer document and then edit your draft rigorously.

**5. The thesis is shaped through interaction with an advisor.** Throughout this project, you will be involved in a particular kind of close relationship with a faculty member or other professional. *The success or failure of your thesis depends to a great extent on your selection of your thesis advisor*. The advisor should provide you with guidance and feedback through your research process—from helping you define your topic and clarify your questions through designing a study plan and locating appropriate sources to analyzing data and drawing conclusions. Learning how to draw on your advisor for help is an important part of the thesis experience.

**6. The thesis is scholarly.** This criterion both sums up and goes beyond the other five. A clear understanding of scholarship is important, both as a goal for your own work, and as a standard to judge the sources you use. A work may be considered scholarly without meeting all of the criteria below, but the more strongly it meets each of them, the more scholarly it is. The

following list of six qualities, adapted from Mauch and Birch (1987, pp. 16-18), characterize written scholarship.

a)  "A scholarly work is published in a respected, refereed journal or in book form in the field of specialization appropriate to the subject of the work."  This will be true of the scholarly sources you use from the library (see Chapter 4 for a discussion of the referee process); in most cases it will not be true for Environmental Studies senior theses (see Chapter 14 for exceptions).

b)  "It is based upon the expert wisdom and literature of the field.  The work indicates that the author is familiar with the conventional wisdom of the field [in other words, the common assumptions and beliefs of other scholars studying your topic], and if it departs in new directions, it presents a sound and rational defense for its departure."

c)  "It demonstrates the workings of a thorough, careful, critical, and analytic mind, looking at all sides of any proposition, examining and testing hypotheses, setting up and knocking down arguments, and marshaling in a complete and fair way all the facts in the process of critically analyzing the study's findings.  A scholar will, of course, believe and support the findings of a careful investigation, but a scholar is not an advocate or a promoter.  The scholar is evenhanded and is willing to entertain the possibility that errors can be missed by even the most watchful investigator."  In other words, a scholarly work demonstrates a search for truth rather than a defense of a too-hasty conclusion.

d)  "It demonstrates to other scholars that the writer is a competent specialist who understands the theories and concepts of the domain and who has a systematic knowledge of the chosen field rather than a smattering of insights here and there."

e)  It is honest about the author's political commitments and moral values relevant to the object of study.  It does not pretend to be value-free, but rather it recognizes that an author's values and commitments will inevitably inform his or her work, especially in an area as value-laden and politically charged as study of the environment.  It *does*, however, attempt to compensate for any blindness or distortion that the author's commitments may cause.  It seeks and presents fairly any evidence counter to the author's assumptions; it is not a polemic in favor of the author's point of view.

f)  It is at least potentially useful to other writers.

Don't be overwhelmed by all of these criteria.  A Ph.D. dissertation or an article published by one of your professors in a professional journal may not meet all of these criteria fully, but they are goals for which to aim, and the closer you come to them, the better your thesis will be.  While your thesis is not a Ph.D. or M.A. thesis, it *is* a project requiring a major commitment of your time and energy.  Perhaps the most important piece of advice in this manual is the following, from a student who completed her thesis in 1990:  "**Love your topic**."  Otherwise you may not be able to stick with it all the way to the finish.

**NOTE:  You will find it helpful to spend some time looking at actual senior theses.**  The theses written by students in the past are kept on file by the Environmental Studies Program and are available for examination, just as yours will be.  The Environmental Studies office is currently placing a record of all senior theses into a computer data base, which you can use to search by author, title, and key words.  Start by asking to look at the card file in the office; it

contains an *abstract* of each thesis.  By looking at several theses on topics which interest you, you can get a good idea of the range of approaches, the degree of depth, the patterns of organization and forms of presentation that are acceptable.

# CHAPTER 2

# JUSTIFICATION: WHY DO A SENIOR THESIS?

It's obvious that this thesis will require a lot of work from you. To the program, it is clear that Environmental Studies graduates must possess well-developed research, analytical and communication abilities in order to be successful in demanding roles after graduation. Your efforts to develop these essential abilities during your undergraduate years culminate in the completion of the senior thesis requirement. In the work you do and in your activities as a responsible member of our society, you will need the abilities developed through the thesis: researching, analyzing and evaluating data, and writing and speaking about your knowledge and conclusions.

In preparing this manual, we decided to test our belief in the importance of the senior thesis. We distributed a questionnaire to 500 Environmental Studies graduates (year of graduation: 1969 to 1990) and roughly half (251) responded. Nearly three-fourths of the group were presently working in a field that involves environmental issues; their jobs ranged from city planner to regional habitat manager to air quality engineer to owning their own environmental consulting firms. The remaining quarter were not working in environmentally-related fields, but were doing work as varied as real estate appraiser or boat-builder.

During their residency here, these students were required, and often reluctant, to undertake the senior thesis project. We asked these graduates if the thesis had been optional, would they have done it? Roughly half reported that they would have avoided it, for one or more of the following reasons: 1) fright, 2) laziness, 3) too much work, 4) not enough time to do the thesis, 5) wanting to graduate on time, or 6) wanting to take other classes. *However, the graduates reported overwhelmingly (over 90%) that if they had not done the thesis, they now feel that they would have missed an important educational experience*.

What would they have missed? Typically, these graduates reported that through doing the thesis, they learned how to follow a major project through to completion. They learned how to use the library, how to talk to professionals and professors about their subject, and how to gather and analyze data. In learning that they could complete a long document, they reported that they gained confidence, improved their writing skills, improved their ability to make oral presentations, and improved their time-management skills. One graduate, a lawyer, reported, "I learned that research involves persistence, creativity and thoroughness—which I have often had to utilize in legal research." Several reported another benefit. Either the skills they developed or (more typically) the knowledge they gained about a specialized area of content led directly to their first job in environmental work.

For most of these graduates, the senior thesis modeled a process of inquiry and communication that they now use professionally. Of those currently working in environmental fields, 95% said that "thesis-like" activities (e.g., gathering and analyzing data, planning, drafting and editing reports) are either "important" or "extremely important" in their work. Perhaps more surprisingly, a strong majority of those *not* working in environmental fields reported the same. For example, a city planner reported, "In my profession I'm involved in research, analysis,

synthesis and presentation on a weekly basis."  Another graduate said that the thesis modeled professional processes "to a great extent!  In a sense my senior thesis prepared me to write my master's thesis.  The master thesis prepared me to write a book-length manuscript.  They are stepping stones."

Moreover, these "thesis-like" activities of gathering and analyzing data, planning, drafting and revising reports occupy a major amount of the time Environmental Studies graduates spend at work.  One quarter of the graduates working in environmental fields spend over 80% of their time in such activities; two thirds of them devote more than 40% of their time to such work (Table 1).  Among graduates working in non-environmental fields, over half spend more than 20% of their time doing "thesis-like" work.

To sum up, the thesis is a chance for you to explore in detail an environmental issue of interest to you and  a chance to develop a set of abilities that you will probably use throughout your career.  Furthermore, it is an unusual opportunity at the undergraduate level for you to produce a document that, in its form and content and its overall size, can become part of a portfolio you can present to potential employers to demonstrate the abilities you have developed.  You have made a wise choice.

# CHAPTER 3

# CHOOSING A TOPIC, SELECTING AN ADVISOR, AND MAKING A RESEARCH PLAN

## 3.1 The First Step

During your first quarter enrolled in Environmental Studies 197, you should get your senior thesis underway; you should spend the remaining quarters bringing the thesis to completion. The beginning *process* will involve a lot of backing and filling, starting and stopping, refining and focusing. Expect to do a lot of tasks at once, then go back and do some of them over again. If there is one lesson to learn from this experience, it is that a project of this complexity usually doesn't move in a straight line from start to finish.

## 3.2 Choosing A Topic

Your topic will be in the social, physical, or biological environment—or some combination thereof. You may already have a pretty good idea of the topic you want to focus on. Your previous course work and other experience in environmental studies has, we hope, moved you to choose a topic area that drives your desire for more in-depth study. You can look at your past academic activities—short papers you've done in previous courses, readings or other work that have connected you to specific issues and problems—as a base from which to start. It *is* OK—in fact, it is recommended—that you build on previous work, using both the knowledge and interest you have already developed. You may begin with several possible topics in mind, or with several possible approaches to one large topic area. When you have some strong possibilities in mind, it's time to look for an advisor. Your final decision about a topic should be worked out, as you talk with potential advisors, not before.

## 3.3 Who Should You Ask?

An advisor might be an instructor you have had in a previous course, or someone who has supervised you in an internship. The thesis advisor must be qualified in your topic area and must have a significant interest in the field; the advisor must also be willing to work closely with you. The following list suggests (but by no means exhausts) the kinds of places advisors might be located:

### 3.31 The Academic Community
- University faculty members (either at UCSB or elsewhere)
- University research associates
- University Ph.D. candidates
- Professional members of the university staff (such as the health and safety officer or the university planner)

- Teaching assistants who are advanced to Ph.D. candidacy or who are working members of a research group

### 3.32 Outside the university:

- Government agencies (local, state or federal), such as:
  - National Park Service
  - National Marine Sanctuary
  - US Forest Service
  - California Energy Commission
  - California Coastal Commission
  - California Fish and Game
  - California State Parks
  - Santa Barbara City Council or County Board of Supervisors
  - City or county energy groups or planning groups
  - Master teachers in public schools for environmental education
- Academically qualified individuals in businesses connected with the environment, such as land-use consulting firms or energy consulting firms
- Academically qualified individuals in private organizations connected with the environment, such as The Nature Conservancy

# 3.4 Exploring Possibilities: The Advisor

Once you've decided on one or more potential topic areas, then—during the first three weeks or first month of 197—you need to interview potential advisors. Talk to more than one person. The purpose of these interviews is to determine if you can work on a given topic and if this person would be both qualified and willing to work with you. *Your final decision about a topic should be worked out as you talk with potential advisors, not before.* As you discuss a general area of interest with potential advisors, they can tell you how they could help you, suggest sources and lines of inquiry, and help you focus and define the problem. You may have a dynamite topic but can find no one both qualified and willing to serve as your advisor; if so, our advice is to put it on hold until sometime later in your life, and choose another topic with which you can establish a working relationship with an advisor. *Remember, you are negotiating to establish the relationship that may well determine whether you succeed or fail in your thesis.* Give this search for an advisor the time and energy it requires.

What might an advisor contribute to you? At the beginning stage, the advisor can offer encouragement, leads and information about useful sources, and provide guidance toward specific problems in your topic area that need investigation. The advisor may help you select an appropriate research methodology. As you develop your research plan, the advisor can critique your ideas by asking critical questions, alerting you to potential difficulties and guiding you toward a narrower and more precise focus. As you gather information, you can talk with your advisor about how it fits together and what it means. When you actually write the thesis, you can ask your advisor to comment on drafts of the chapters.

Why would someone be willing to serve as an advisor on a thesis project? As a thesis researcher, you are asking for valuable time from an advisor: scholarly interaction, guidance and feedback—in formulating your topic, in designing a data collection strategy and finding

resources, in analyzing your data and drawing conclusions. Why would a busy professional be willing to invest such time and energy in your work? Primarily because that person shares with you a *commonality of interest*. What you propose to work on will benefit the advisor as well as you: your work will feed your advisor's scholarly or professional interest. Your thesis work may in fact perform specific services for the advisor: perhaps you become part of a faculty member's research group and organize and interpret some of their data, or perhaps you delineate issues for a government planner who will be making policy recommendations about those issues. But even if your thesis work does not make such specific contributions to the advisor, your interaction can offer the advisor new information and new insights, and thus a successful relationship with an advisor will contribute to you both. Therefore, as you interview potential advisors, make sure that you answer both of these questions: can this person help me, *and* will my work on this topic contribute to the advisor?

Since you are negotiating a mutual relationship which requires a significant amount of time from both sides, it's logical that some people you approach may turn out not to be appropriate. Faculty members and other professionals are busy; they may well turn you down if they don't see enough benefit for them, or if they simply cannot make the time. *But you have the right to at least ask*. Faculty members, for instance, are required to hold office hours; during an office hour you can explore the possibility of their serving as your advisor. Public officials are paid in part by your taxes; you have the right to call and make an appointment to discuss the possibility of working with them. Likewise, the fact that you've spoken with someone about serving as your advisor does not commit you to them: you have the right to decide that someone you've interviewed is not who you want as an advisor.

Before you make an appointment with a potential advisor, make sure that you have something to talk about. Plan an agenda. Focus potential topics into two or three written potential research questions. You will learn more—and have a better chance of convincing the person to serve as your advisor—if you demonstrate a serious effort to prepare for the interview, if you show that you can accept responsibility for the initiative.

Sometimes faculty members go on leave to conduct research; other professionals sometimes have commitments that make them unavailable for particular blocks of time. In your negotiations with potential advisors, you will need to make sure that the advisor will be available to work with you throughout the thesis process. Sometimes, too, students discover that they need longer to complete the thesis than they originally forecast. Thus you will need to ascertain your advisor's availability for the entire thesis process.

If all goes well, you will rely heavily on your advisor for scholarly guidance. At the same time, remember that *you* are responsible for initiating contact, for asking for help and advice, for bringing in progress reports, problems, and drafts of chapters for feedback. Because the purpose of a thesis requirement is to help you develop the ability to do independent scholarly work, the margin between success and failure at the thesis is at least partially the amount of initiative and responsibility for independent work that you take on.

## 3.5 Research Approaches and a Research Plan

As you choose a topic and negotiate a working relationship with an advisor, you will begin to develop a research plan. Unlike the choice of topic and advisor, which should be selected by the end of your first quarter, your research plan may continue to evolve even into the actual writing of the thesis. With your work during subsequent quarter(s), you will articulate several stages of your research plan, using the forms provided in the syllabus.

### 3.5.1 Forming hypotheses:

Usually during the formation of the research plan, the questions with which you started will become focused into one or more hypotheses; your research activity will then consist of working out an appropriate method to test the hypothesis, applying the method to collect data, and using the data to confirm or disconfirm the hypothesis. You will remember that broadly speaking, a hypothesis asserts a relationship which you have reason to believe may hold but which you do not in fact know; a working hypothesis must be stated in a form which is testable; and the point of using a hypothesis is not to prove it true, but to use it as a probe to determine what can be learned. Almost any researchable question can be focused as a hypothesis, and then be tested. If you have a project in mind for which hypothesis testing is inappropriate, you will need to justify an alternate approach in your research plan.

### 3.5.2 Type of inquiry:

As part of your research plan, you will need to select a type of inquiry to pursue, and describe how you intend to pursue it. Your research will probably embrace one or more of the inquiry types on the following list, adapted from Mauch and Birch (1983, pp. 70-73):

1) **Analytical:** in which you collect data and sort it out into categories.

2) **Comparative:** in which you examine two or more situations for their similarities and differences.

3) **Design and demonstration:** in which your design (of, for example, a curriculum package in environmental education, or a piece of environmental technology in environmental engineering) is followed by your implementation or operation of what you designed to test it out.

4) **Historical:** in which you study past interactions between cultures and their environments.

5) **Case study:** in which you examine the "background, development, current conditions, and environmental interactions" of, for example, an ecosystem, a political organization, a governmental unit or agency, or an environmental planning process to determine stages or patterns.

6) **Experimental:** in which you conduct controlled experiments to determine cause-effect relationships—perhaps as a part of a larger research group associated with a faculty member.

**7) Correlational-predictive:** in which you seek statistically significant correlations between and among environmental phenomena, determining to what extent variations in one factor correspond to variations in others, and determining to what extent you can make predictions based on those relationships. This method is similar to the experimental approach without conducting the experiment. For example, a study which correlates data about access to safe drinking water in a Third World country with data about infant mortality in that country might identify certain patterns of relationship between these data sets. If the study predicts that those patterns will be found in the other data sets and then tests to see to what extent they are present, it is a correlational-predictive approach.

**8) Survey research:** in which you use statistical measures to determine, report, and interpret the "behaviors, beliefs, or intentions of specified groups of persons."

**9) Trend analysis:** in which you examine environmental phenomena that are currently changing in order to determine the direction and size of the changes and to forecast the phenomena's future status.

**10) Evaluation:** in which you examine a program or project (for example, an energy conservation program or mitigations in a development project) which is expected to be carried out in a certain way with certain outcomes, in order to determine in what ways and to what extent the procedure and the outcome were realized.

## 3.5.3 Articulating limits:

Your study will have various limits. Some limits you will set yourself, in order to pursue what you most want to know, and to keep the project manageable. For instance, if you choose to focus on two sample countries instead of the entire Third World, or on solar photovoltaics instead of renewable energy sources, you are setting limits. Other limits you may encounter will not be under your control: these may include access to sources (information may be squirrelled away in inaccessible locations, or for "cutting edge" topics it may be so recent that nothing much is published) or cost and time constraints. Articulating both the limits you anticipate setting and the limits you anticipate encountering will help define your project.

At the end of this negotiating and planning process, you should have a topic, an advisor and a research plan. Successful passage through this process will allow you to answer "yes" to the following questions:

- Is the project "*do-able*"?
- Is it focused on a specific environmental problem or issue, not simply a vague interest in a topic?
- Is there a database, or can one be constructed in the time frame of the thesis?
- Is there credible, referred literature on the subject? (e.g., scholarly books and academic periodicals; see Chapter 4 for more on this) Is a search of this literature manageable?
- Is the project of a scale that will allow you to present it in roughly 30-40 pages?
- Is the project environmentally applicable?

- Is there current interest in this topic?
- Is the problem or issue important—either in itself, or through its impact on other systems, or as an example of larger issues?
- Is there a gap in knowledge that your work on this topic could help to fill? A controversy it might help to resolve?
- Is your advisor both qualified and willing to work with you on this topic?
- Is your advisor available to work with you throughout the entire thesis process—including any unusual time constraints or circumstances?
- Do you have a research plan that can guide you?
- Have you identified the appropriate type or types of inquiry your topic requires?
- Have you pushed your central questions into hypotheses—or worked out an alternate approach?
- Have you identified the important boundaries or limits to your project?

## 3.6 Preparing a Preliminary Thesis Outline

An important part of developing an adequate thesis plan is the preparation of a preliminary thesis outline, setting forth under major headings and subheadings the specific subjects or areas which comprise the major parts of the whole undertaking. Which particular aspects do you intend to include in or exclude from your inquiry? Your preliminary thesis outline will help you and your advisor to ask and answer the appropriate "focusing" questions at the outset as you look ahead together.

## 3.7 Preparing an Annotated Bibliography and a Detailed Thesis Outline

At the end of fall quarter, you are required to prepare and submit to your instructor an annotated bibliography. At this point you will hopefully be in a position to look back on a substantially completed research program which you have undertaken with the guidance of your preliminary thesis outline. The annotated bibliography is a tool which allows you, your instructor and your advisor to assess your research program: the bibliography shows what **sources** you have found; the annotations show what **contribution** each source is likely to make to the final thesis. (See Appendix A for examples of both annotated bibliographies and detailed thesis outlines from this point in the process.)

At this time you are also required to prepare and submit to your instructor a **detailed** thesis outline. Note the emphasis on "detailed". Looking back on your preliminary thesis outline, now you should be prepared to make refinements to and elaborate **extensively** upon the skeletal structure of that outline. That accomplished, you may readily begin to write.

# CHAPTER 4

# GENERATING A BIBLIOGRAPHY

## 4.1 Library Limitations

At the same time that you are deciding on a topic, choosing an advisor, and working up a research plan, you will need to find out if you can get the sources you will need. One of the places to look is the library. There you will need to ask three major questions:

1) Do enough quality sources on my topic exist? (What is a quality source? How do you find out what exists?)

2) If quality sources exist, can you get them?

3) If you can get them, can you use them?

If the answer to these three major questions is **YES!** then you have a topic with which you can proceed. This chapter will suggest some of the ways to go about answering these three questions.

## 4.2 Do enough quality sources on my topic exist?

The answer to this question is usually "yes", but with some topics—the extremely new, the extremely specialized or obscure, the extremely localized—there simply may not be enough written as yet.

### 4.21 What is a quality source?

Basically, it is a source—an article, a book, a database, an interviewee—that provides you with reliable and current information about your topic and/or a useful conceptual framework for relating various elements of your topic. You must judge the quality of your sources: their reliability (their internal coherence, their consistency with known facts, their possible bias) and their relevance to your topic. Generally newspaper articles are not quality sources.

### 4.2.2 Primary vs. Secondary Sources

Sources can be divided into two types: primary sources and secondary sources. You will draw on both. **Primary sources** are the raw data that scholars use. You may generate some of your own primary material—results of a survey you conduct, for example, or the transcript of an interview you carry out, or field notes from your observations in the field. You will also find primary material collected in the library and in other places such as an organization's files or an archive. Examples of such sources

would be census data and other statistical data collected by government agencies, letters (either collected in an archive or published as letters to the editors of newspapers), and original manuscripts. If you are working as part of a research team, your team will be amassing primary data, and you may be given some of it to analyze.

**Secondary sources** are perhaps more familiar to you. These have already passed through the "filters" of an investigator's mind; they are analyses or syntheses of primary material. A report on the trends of acid rain over the last decade is one example; most journal articles and scholarly books would be classified as secondary sources. Secondary sources establish relationships and offer conceptual frameworks for interpreting their data; they can help you better understand and interpret the information you get from primary sources. It is important to note that a source may act as both a primary and a secondary source, depending on when and how it is used. A report analyzing the effects of deforestation is a secondary source when written, but later may be a primary source for the land use history of that particular time.

## 4.2.3 Sources in Print

Many of your sources will be printed publications, and these can be divided into at least four types: reference works, popular sources, scholarly material, and government publications. **Reference works** may be a good place to start. Examples include: Encyclopedia of Environmental Control Technology (1989; call number TD 191.5 .E5), three volumes of technical articles on thermal treatment of hazardous wastes, air pollution control, and wastewater treatment technology; the Encyclopedia of Beaches and Coastal Environments (call number QE5 .E58 v.15 SEL Ref), one volume covering everything from coastal morphology and ecology to surfing; and the Encyclopedia of World Problems and Human Potential (1986; call number H 49.5 .E528 Ref), a comprehensive source identifying the range of world problems, conceptual approaches to and strategies for problem solving. You can probably locate articles in one or more of these specialized encyclopedias that relate to your probable thesis topic; from the article you can get an overview of issues to consider, perhaps the names of organizations or individuals who play important roles in relation to your topic or a sketch of relevant history, technology, or economics, and almost always a list of references for further study. Please see appendix C for other specialized indexes.

**Popular sources** (newspapers and newsmagazines, other magazines or books written for a large, general audience) may provide some useful information or allow you to track very recent developments in your issue. However, popular sources must be used very judiciously in a scholarly work such as your thesis. Articles, for example, may be written by journalists who don't fully understand the issue about which they are writing, and while the extremely short lag time between the occurrence of an event and the publication of news about the event allows you to get very recent information, it also generally prevents the analysis or contextualization necessary for fuller understanding.

A book or article is considered **scholarly** when it is authored by someone who studies the issue as part of his or her profession. But in addition, it has passed through a quality control process called "peer review." This means that before accepting the work for publication, the publisher has sent the manuscript to other respected members of the

author's field, who agree that its methodology is appropriate and its findings are important enough to be worthy of publication. While this process doesn't guarantee that the article or book is correct, it does increase the likelihood that the work contributes significantly to knowledge in the field. **Therefore, your thesis needs to be built on a solid foundation of scholarly work.**

**Scholarly books** are typically published by university presses (such as the University of California Press) or by groups such as the National Research Council (publishing through the National Academy Press). Scholarly articles appear in scholarly journals (ranging from general journals such as *Science* or *Nature* through somewhat more tightly focused journals such as *Ecology* to highly specialized journals such as *Journal of Wildlife Management* or the *Annual Review of Entomology*. You can tell if a journal is scholarly if it is published by a professional society and if its guidelines for publication include a peer review process. **For most thesis topics, scholarly journals will be more important than books, because they are usually more current and specifically focused.**

**Government publications** may include laws and regulations relating to your topic, may include environmental impact reports or other reports published by local, state, or federal government or by international organizations such as the United Nations, or may include testimony by experts in Congressional hearings. The Government Publication section is located on the first floor, at the end of the hallway, near the rear entrance to the library.

## 4.3 How Do I Find Sources That Relate to My Topic?

When beginning your research, check journal articles for works cited and references. Take note of the authors, titles, journals repeatedly cited and include them in your own searches. But how can you find those first sources? The library has many "finding tools" designed to help researchers find the resources they need. Four of the major tools are indexes, abstracts, citation indexes, and the catalogue.

### 4.31 Research Tools

**Melvyl** is the University of California's database of library and article collection. It organizes the contents in numerous databases ranging from journals about education and business to anthropology and literature, and will help you locate information at any UC library as well as in libraries around the world (however try to limit your searches to those resources contained within the UC system unless you plan on traveling). **Pegasus** contains only those items found in the Santa Barbara library. For directions on how to use Melvyl and Pegasus, please turn to Appendix C. Appendix C also contains information on remote access to these databases (accessing them from home), and directions on how to access Melvyl on the web (on-line Pegasus will soon follow).

**Indexes** list in alphabetical order subjects, authors and title of articles from a set of periodicals in a particular field. Examples range from the Readers' Guide to Periodical Literature (for popular magazines) to the Public Affairs Information Service (PAIS)

Bulletin (for social science sources) to more specialized indexes such as the Population Index (for articles specifically on population issues). Please see Appendix C for additional applicable indexes available.

**Abstracts** are organized much like indexes, dividing their coverage into various subjects and providing author and title citations for articles on each subject. In addition, however, for each citation they provide an abstract—a summary (usually 100-150 words) of the key features of the article being cited. Using an abstract (such as Environment Abstracts, Rural Development Abstracts, or Pollution Abstracts), you can not only locate potential sources but also quickly evaluate them, deciding whether they will contribute to your research and writing. [NOTE: A number of abstracts and indexes have been put in machine-readable form on CD-ROM disks; you can use the computerized reader to sort through them, then print out any sources you select. Ask for help at the reference desk.]

**Citation indexes** (namely, the Science Citation Index and the Social Science Citation Index) are useful if you have found an excellent source which is a few years old. The citation index will provide references for all the articles in a wide range of journals which have referred to (or cited) your source since it was published. Thus you can track the more recent work that has built upon your original source. Where the references in articles or books take you back in time, to the earlier sources used by the author, the citation index can take you forward in time, to later sources that cite the author. [WARNING: the citation indexes are cumbersome and clumsy to use, so ask a librarian for help at first.]

Additional reference resources include the following:

1) Dictionaries and encyclopedias
2) Handbooks and guides
3) Directories
4) Biographies
5) Bibliographies

You can find more detailed information about these resources in Appendix C.

**Interlibrary loan process.** If other UC libraries have on reserve the magazine, journal, or book that you need, you can fill out an interlibrary loan form (example in Appendix C, available in the library at the science and engineering desk).

## 4.4 If You Can Get Them, Can You Use Them?

Once you find a source, skim it quickly. You might look at the abstract, the figures and tables, the introduction and the conclusion. You need to decide if it is relevant to your topic, if it appears to offer something significant in understanding your topic, and if it is written at a level that you can understand.

Your job during the early stages of your library search is not to absorb everything you read, but simply to find out what's available to you. You're conducting a reconnaissance, a preliminary search to help you get a sense of the boundaries to your topic, and to make sure that

enough material is available for you to proceed.  Poke around in a lot of places, and play in your mind with the different directions that your material may be leading you.  If you find a useful book, check it out and look up the references it cites.  When you find good articles, make copies of them, and be sure to get the full reference (name, volume number and date of journal, page numbers of article) so you won't have to relocate it to find the information you need.  You'll probably get stuck at some point, and when you do, ask a librarian for help.  They know lots more than we've put into this chapter.

# CHAPTER 5

# ESTABLISHING A TIME-LINE AND DEADLINES FOR SPECIFIC TASKS AND STAGES OF THE PROJECT

Time is vitally important in all aspects of the thesis work, and an effective time management program must be developed and adhered to in order to assure the timely completion of the several thesis tasks. The time management skills you learn from this project will help you in any line of work, as well as your daily life.

You must set deadlines for the completion of several sequential and overlapping tasks. Make these deadlines realistic and, once set, not subject to alteration except in response to extraordinary circumstances. Setting and keeping to deadlines will provide you with a valuable experience in self-discipline, allowing you to reap the rewards of time management and spare you the agony associated with procrastination. Your time management will determine the emotional success of this project.

As a part of your thesis plan you will prepare a time-line showing when you intend and/or are required to perform certain tasks. This time-line should cover the entire period of time from the beginning to the conclusion of the thesis work, even if it spans over several quarters. The time-line on the next page sets forth *some* of your major deadlines. You may adapt this form or make up your own to set forth additional tasks and times, as appropriate to your particular thesis plan and needs.

Examples of detailed outlines and annotated bibliographies can be found in Appendix A.

# CHAPTER 6

# DEVELOPING A BUDGET:
# THESIS COSTS AND POTENTIAL FUNDING

A budget is part of any research plan, and like any researcher, you will have costs in producing your thesis.  As you develop your intellectual agenda, it's a good idea to estimate the costs you will incur in carrying it out.

You can count on some expenses in producing the final documents: you'll need a copy for your advisor, a copy for the program, and at least one copy for yourself (you may want another copy to include in a portfolio of your work that you show to prospective employers).  Include in your budget, sot for at least three or four copies (or more if your want to make more copies for other people who have contributed substantially to your research).  If you choose to print out the original of the final copy on the laser printer in the Instructional Computing Lab, plan to spend $0.50 per page.  If you use photographs for some of your illustrations, you'll need to figure in their cost as well as the cost of color copying if needed.

You'll incur expenses in conducting the research, as well.  You may choose to make copies of a lot of journal articles or government publications.  You may need to buy books, purchase reports from the government, or buy some other materials.  You may need to interview an expert by long-distance phone.  You may need to cover travel expenses to use a library or an archive somewhere else, or to conduct field observations at a research site.  Some of these costs—especially travel costs—could be substantial.

You may be able to receive full or partial funding for the expenses you incur in your thesis.  Here are a few possibilities you may want to explore:

1) Some funds are available through the University of California President's Research Fellowship Program.

2) Some thesis writers join research groups directed by their faculty advisors, and conduct their thesis research as part of a larger research project which the group has been funded to carry out.

3) Some thesis writers combine their thesis research with an internship, and are supported by the agency with which they are interning.  Local government planning offices, for instance, might pay you to do research that they can use.

<div align="center">

**CHAPTER 7**

**USING A COMPUTER: WORD PROCESSING AND OTHER USES**

</div>

## 7.1 Word Processing

If to this point in your college career, you have managed to avoid learning to use a computer, *now is the time to learn!* At the very least, you will need to produce this thesis on a word processor. Like almost all professional writing, your thesis will go through multiple drafts, subject to major reshaping and minor polishing. A word processor produces a clean copy after each revision, without requiring you to go through the tedious work of retyping it each time. It also allows you to easily create alternate versions when you need to see them to decide which way to go.

We have no preference concerning the program and machine you use. Just make sure that it meets these requirements:

1) Will the machine be accessible to you throughout the time you are working on the thesis? (e.g., don't use a machine that belongs to a roommate who may move before you finish, or to a girlfriend/boyfriend you might be breaking up with.)

2) Does the system have enough memory to store everything you write? (e.g., don't use an electronic typewriter that can store five to twenty pages of text and then has to dump its memory to take in more.)

3) Does the machine have the capacity (memory) to save the document on a disk (floppy, 3.5", or zip)?

4) Do you have access to a printer (laser or bubble jet—no daisy wheels or 24-pin dot matrix printing for your final draft)? You can work around not having a printer, but completing your thesis will be much easier and less stressful if your have one.

If you don't have a word processor of your own or guaranteed access to one, your enrollment in ES 197 entitles you to use the Instructional Computing Lab (IC). IC offers Microsoft Word in Macintosh and IBM formats. If you need help in learning how to use this or other systems, IC offers orientations near the beginning of each quarter. For more information, contact the IC office at 1521 Phelps.

Word processors are marvelous work savers, but they do have a down side: every quarter someone reports in frustration, "The computer ate my thesis." This frustrating occurrence will not excuse you from meeting any deadlines. To insure that the computer does *not* eat *your* thesis, follow these guidelines:

1) **SAVE YOUR WORK** every 10-15 minutes. If the computer crashes, most of what you've put on the screen will be on the disk.

2) **PROTECT YOUR DISKS**. Keep them away from magnetic fields (fluorescent lights, television sets, etc.—remember, all that data on the disk is magnetically encoded and can be magnetically *un*-encoded). Keep them physically secure, in a carrying case, protected from beach sand, peanut butter and jelly, and anything else that might muck them up.

3) **BACK UP YOUR DISKS**. Whenever you've written a substantial amount (a chapter, 10 pages, or whatever seems substantial to you), copy that file onto a back-up disk that you keep somewhere away from your working disk. If you lose the disk or muck it up, you've still got most of what you've done on the back-up disk.

4) **PRINT OUT YOUR DRAFTS AS YOU GO.** This is useful to you as a writer, because sometimes it's easier to see what you've done when it's on the page instead of on the screen. But it's also useful as a way to preserve your work, in case you haven't backed it all up and something happens to your disk.

## 7.2 Other Useful Programs and Gadgets

Almost every word processor has a spell checker; **USE IT** before you distribute your drafts. In addition to the word processor, you may find other programs useful. MacDraw, for example, will allow you to create a wide range of visuals. Excel is one of several programs that can place data in a table and then convert it to graphic displays such as histograms or linear graphs. Both of these programs are available in the Macintosh and Pentium Labs. The IC also has a scanner that can "read" a visual image into computer memory, so you can scan a photograph, a map, or a graph and print it out as part of your thesis. The Humanities and Social Sciences Computer Facility in Ellison 2626 has a number of statistics packages that help you organize and analyze data. Systat is one package available on the Macintosh and PCs which performs descriptive statistics (i.e., means and standard deviations) and graphics.

CHAPTER 8

DATA COLLECTION AND INITIAL DATA ANALYSIS

A project the size of the thesis sometimes feels overwhelming. If you've gotten this far, you've focused a research question, chosen an advisor, and you've made a plan and a budget. At this point you may be tempted to continue tinkering with the plan—to refine it, redirect it, maybe dump it altogether and start over. Some of that may be necessary, but you may also be avoiding the new and threatening. If this rings a bell, remember this: *every stage* of this thesis process (whether it be research design, data collection, data analysis, or writing it up) is likely to feel at least a little threatening when you first encounter it, because it's difficult and unfamiliar. But, after you've worked at that stage for a while and learned how to do it, that same stage will feel comfortable to you and you'll see more and more you could do and you'll be reluctant to leave it and go on to the next. It's normal in a project of this size to want to stay with the familiar and avoid the difficulties of the new, finding it hard to move on.

Nevertheless, at some point you have to push off and keep going. The next new stage in your process is collecting your data.

## 8.1 Data Collection

Some of your data will come from print sources (articles, books, government publications and the like). Different researchers collect data from these sources in different ways. Some make note cards; others make copies of everything they find. Others make notes in a notebook, or type quotes and summaries into computer files. Use whatever system works for you—and make sure that it includes these two features:

1) Your notes or files need to be labeled by title or topic so you can retrieve the appropriate material when you need it later. This is important enough on the senior thesis project; it becomes even more important in later work when you have bigger projects or more of them going at once.

2) Your notes or files need to be clearly marked with all the reference data, so you can cite your sources accurately without having to go back to the library and trying to find the journal or book again. This includes page references for each page that you quote from.

Other data may come from other activities—interviews, surveys, field observations, controlled simple experiments, and the like. Each of these methods has its own protocols for recording data; make sure that you know the standard ways for capturing data if you undertake any of these methods. Your advisor can help you here by explaining data collection methods or referring you to appropriate sources and models.

While you are engaged in data collection, you will probably find it useful to keep a separate notebook, or a separate column in your notebook, or a separate computer file in which you record your reactions, thoughts, feelings, questions, ideas, tentative interpretations, and any

other reflections you have on the data collection process and the information you are gathering. Such a process record can become an invaluable "second-order" source of data, indicating potential problems, patterns, biases or implications of your "first-order" data. It may lay the foundations for the conceptual framework you use to order your information, or it may clarify difficulties in your research procedure that lead you to alter your methods or your goals.

## 8.2 Initial Data Analysis

After you've collected a substantial amount of data (reflecting on it as you go, as suggested above), read through all your notes and records. Don't try at first to place it all in categories or draw conclusions; just look at it all together and mull it over. See what elements strike you as interesting; see if any patterns emerge. Perhaps take some notes about what you notice; you might want to write for five minutes about each point that feels significant. From a relaxed reflective point of view, your mind will try to make sense of it all, probably attending to the most powerful and important features in your data.

From this point on, you'll be moving in a kind of spiral from data collection to data analysis and back to data collection again. Patterns you see and associations you make will lead you to new questions, and you will likely be driven to collect different information in order to test a hunch or explore a relationship. After analyzing your new data and reaching tentative conclusions, you will be driven back to collect more data to see if your conclusions stand up. This back-and-forth recursive process which builds upon itself will probably continue through the remainder of the writing process. The perspective for which you're striving allows an interplay between your intuitions about connections and relationships and your logical, rigorous testing of hypotheses.

CHAPTER 9

THESIS FORMAT

In every field, professional communications (journal articles, grant proposals, environmental impact reports, or whatever) are structured in accordance with specifications that are more or less clearly spelled out and more or less widely known. These specifications vary in their details from field to field, and indeed between sub-fields or kinds of communication within a field. Nevertheless, they govern every professional communication, and this thesis is no exception.

Rules or "conventions" for format and structure serve at least two purposes. For the author, they insure that at least some specified range of material is covered and included, and that important elements from that range are not totally left out. For the reader, they create clear expectations for the kind and form of information to be presented, so that it may more easily be located and taken in.

The following is the format that must be followed for the senior thesis in Environmental Studies. This manual itself exemplifies many of the elements in the required format (although your chapters are likely to be both longer and fewer).

## 9.1 Brief Description and Arrangement of Major Parts

Your paper must contain the following sections in order.

### 9.1.1 Title Page:

This bears the title of your thesis, your name, your advisor's name, and the date of completion, among other data (see Appendix A). The title is one of the most important features of any professional document, because technical readers use document titles to decide which documents are likely to be relevant to their own particular research or action needs, and therefore which documents are worth retrieving for further examination. Your title may be the very last thing you write. It may not be jazzy or elegant, but it needs to be precise and comprehensively identify your thesis topic.

### 9.1.2 Abstract:

As the second page, the abstract serves as the second most important "access tool" for potential readers of your document. See Chapter 14 for a more in-depth discussion of the abstract, Appendix A for the form, and both the front of this manual and sample theses on reserve in the ES Peer Office for examples.

### 9.1.3 Acknowledgements:

Virtually no scholarly work is done by an individual working entirely alone. You will draw on others and be influenced by them as you research and write. Perhaps an experience in earlier life predisposed us to work on a given topic. Perhaps an article you read or a lecture you heard organized a problem for you crisply and clearly. Perhaps conversations with mentors or friends helped clear the mud from your thoughts, or maybe some organization supplied you with funding to do your work. This section allows you to acknowledge any form of contribution you desire.

### 9.1.4 Table of Contents:

This shows the major sections and subsections of the document and the page number on which each begins. It will be one of the last sections you finish, so you can get an accurate pagination for all the other sections.

### 9.1.5 Table of Illustrations:

This lists each table and figure in your thesis, by table or figure number and by title, and gives the page number on which each is found. Like the Table of Contents, it will be one of the last tasks you complete.

### 9.1.6 Introduction:

In this chapter you define your problem or issue and show why it's worth pursuing. Often this is accomplished by setting it in its context.

### 9.1.7 Major Sections:

The chapters following the introduction will be divided into the major blocks of thought, and subdivided appropriately with subheadings (as illustrated by many chapters in this manual). For a thesis reporting on a scientific study, you may wish to use the standard division of Methods, Results and Discussion. Other projects may require other patterns of chapter organization, but every thesis must include a description of the research methodology, must present an interpretation of the data collected, and must end by drawing conclusions and, where appropriate, making recommendations.

### 9.1.8 References:

Immediately following the last chapter of text, this section contains the full bibliographic data for every source cited in the text or illustrations—*and only those sources cited in the thesis itself.* If a source was useful to you, cite it in the text and put it in the references; if it wasn't useful, don't put it in either one. Chapter 10 discusses the use of references more fully and the References section of this manual provides an example.

### 9.1.9 Appendices:

The Appendix or Appendices (plural for "Appendix") contain those items which you feel might be valuable for someone using your thesis, but which are either too lengthy or too peripheral to embed directly in the text. Examples might include a policy statement or the text of an environmental law, relevant portions of an Environmental Impact Report, a questionnaire you developed or the transcript of an interview you conducted, or other supporting material.

# 9.2 Layout and Formatting Specifications

The physical specifications for the senior thesis are as follows:

## 9.2.1 Spacing:

Unlike this manual, the text of your thesis is to be **double-spaced**. Tables and material in the append ices, and certain quotations (see 10.3 for more information) may be single-spaced as appropriate.

## 9.2.2 Margins:

Leave margins of one inch at the top and bottom, and 1.25 inch on the left and right sides to accommodate the binding (unless you're using a program like WordPerfect which has a "binding offset" feature—then leave one inch margins on both sides with an offset of 0.25 inch).

## 9.2.3 Pagination:

Number the pages in the "front matter" (abstract, acknowledgements and table of contents) with lower-case Roman numerals (ii, iii, iv, etc.) either centered at the bottom of the page, 0.5 to one inch from the bottom; count the title page as the first page but do not place a number on it.

Number the pages in the text (from the introductory chapter through the references) consecutively with Arabic numerals (2, 3, 4, etc.) either centered at the top of the page or in the upper right-hand corner, one inch from the top and 0.5 inch above the first line of text.

Label each appendix consecutively with a letter of the alphabet (Appendix A, Appendix B, etc.) and number the pages of each appendix with a combination of the appendix letter and the page number (pages A-1 through A-4 in Appendix A, pages B-1 through B-2 in Appendix B, and the like); center the page number at the bottom of the page.

## 9.2.4 Printing:

The final draft of the thesis is to be printed on a letter-quality computer printer (laser printer, ink jet, or bubble jet). Use a printface and font size similar to that in this manual; do not print the thesis in italics, script, or any other non-standard printface.

## 9.2.5 Photocopies:

You are expected to keep the original copy of your thesis and to submit high-quality photocopies to your advisor and to the Environmental Studies Program. To minimize paper consumption, photocopies are to be printed on recycled paper and are to be two-sided. Lay out the thesis with blank pages if necessary so that the abstract, the

table of contents, each chapter, the references, and each appendix begin on the right-hand page—like this manual.

## 9.2.6 Binding:

The final draft is to be bound in a clear plastic cover with the title page showing through, with a binding strip down the left side, like this manual.

This manual not only gives you directions and advice about your thesis; it also is designed to exemplify the format and layout you will use. For any questions you have about format and layout that this manual does not address explicitly, see if the manual serves as an example. For questions you can't answer through the manual, ask your instructor.

# CHAPTER 10

# DOCUMENTING SOURCES

One of the hallmarks of scholarly writing is the fact that it carefully documents the sources from which it draws. Documentation consists of two parts: the **citation** (the information provided at the point in your text where you use material from a source, indicating briefly what you used and where it came from) and the **reference** (the full bibliographical information provided in a list of references after your final chapter).

## 10.1 Why Document Sources?

There are at least three reasons why scholarly writing documents its sources:

**1. To gain credibility.** Students sometimes believe that the originality marking high quality intellectual work means that the author didn't rely on anyone else's work, generating all the ideas and data by himself or herself. **This is a myth!** Every academic writer works within a field which is shaped by the contributions of others, and works with theories, methods and data that others have helped to develop. Sir Isaac Newton, whose invention of calculus and theory of gravitation revolutionized the fields of mathematics and physics, is reported to have said, "If I see so far, it's because I stand on the shoulders of giants." Documenting your sources will build your credibility with your readers, because it locates your work clearly within the community of knowledge making that you have entered.

**2. To avoid plagiarism.** Plagiarism means using the work of others without giving them due credit, so the work appears to be one's own. Plagiarism includes using a source's actual language without citing it and indicating the quote; it also includes using another's data, another's visuals such as tables and figures, and even another's ideas or line of argumentation without clearly citing the source. Whether it's intentional or not, plagiarism is one of the cardinal sins of academic work. It is a form of dishonesty that can have serious consequences. At least one university president, at Southwest Texas State University, was fired when evidence emerged that years earlier he had plagiarized his Ph.D. dissertation; Senator Joseph Biden, running for the 1988 Democratic nomination for President, was forced to withdraw from the race when the public learned that some of his campaign speeches plagiarized speeches made years ago by British politician Neil Kinnock. You can avoid plagiarism by being scrupulous to give credit to your sources.

**3. To serve your readers.** In our view, this is the most important reason for documenting your sources carefully. You will have spent many hours locating, interpreting, evaluating your sources and applying them to the issue under investigation. Documentation keeps readers from having to repeat all the work you did; it marks the trail you have broken through the wilderness of sources. Your readers will want to use your thesis in their own work and will want to follow up on those particular sources relevant to their own issues; your clear documentation will tell them which sources provided what material to you and will give them all the data they need to track those sources down themselves.

## 10.2 How Do You Document Sources?

The fundamental rule in documentation is to indicate clearly what material you are using from another source, and to provide enough information to allow readers to find that source themselves. If you are unable to find out precisely how to handle an unusual source, follow this rule and you will be okay.

The second rule in documentation is to use the format specified in the situation in which you are writing. There is no one right format; there are only formats which have been agreed upon in particular situations. Formats vary between fields and even within fields; Day (1983) reports that one author examined 52 different scientific journals and found 33 different documentation styles required by them.

### 10.2.1 Footnotes and Endnotes

Scholars use footnotes or endnotes, plain and simple. MLA and other styles that place names, dates, publishers, or page numbers in the text are distracting and serve to weaken any thesis. Placing footnotes or endnotes with Microsoft Word or another word processor is as easy as the stroke of a key. Word can make your footnote font smaller automatically, and allows you to renumber, clone, and move footnotes at will. Although you may have learned that the MLA or APA style is the way of the future, for research documents it is not. Forcing a reader to look in two places to see where your source material came from is bad style. Therefore, I want you to use footnotes or endnotes with reference a reference style that will be distributed later in the quarter.

### 10.2.2 References

The page immediately following the final page of your last chapter will begin your list of references (unless you have content endnotes, in which case the references immediately follow the endnotes). Center the word "REFERENCES" at the top of the page. Under it, list, in alphabetical order by last name of author, every source which you have cited somewhere in the thesis, either in your written text or in your illustrations. DO NOT INCLUDE ANY SOURCES WHICH YOU HAVE NOT CITED. (See "What to Cite" below for discussion about this.) **See page 311 in Hacker's *A Writer's Reference* or page 174 in Maner's *The Spiral Guide to Research Writing* for information on APA style Reference section.**

## 10.3 What to Cite

Many students are unsure when to cite sources and when not to cite them. You want to give credit where it's due; yet you also want to write your thesis without a citation for each sentence. A good way to get a sense of how much to cite, and when to cite, is to look at the patterns of citation in the journal articles you're reading. The principle followed by scholars working in a field is *not* to cite anything which is common knowledge within the field; they *do*

cite specific information that comes from particular sources. You want to sufficiently understand the field within which your thesis is situated, so that you may distinguish and cite the specific knowledge, and not commonly understood information.

Here's an example: when you began working in your lower-division environmental studies courses, you were introduced to such concepts as ecosystems, environmental unity, and ecological succession. If you had attempted at that time to write about those concepts, you might have felt obliged to cite the textbook that introduced you to them. By now, however, you recognize these ideas are widely understood without pinning them to a source. The same principle applies to whatever narrower field you thesis is located within; you can use the common understandings of the field without citing them, even if they were initially new to you and introduced to you through a particular source.

Include the following:

- **Numbers:** If you didn't generate the numbers, someone else did. Cite him or her.

- **Research results:** If you're discussing the outcome of a particular study, cite the author.

- **Particular formulations or conceptualizations:** If you're quoting an author directly, or borrowing a particular line of argument, or replicating a particular research methodology, cite your source.

In general, cite sources if you're using material *originated* by someone other than yourself.

Sometimes researchers—both novices and experienced researchers—will spend a lot of their research time reading the literature of the area in which they plan to work, in order to learn the common knowledge in that field. Suppose you're working on biological control of insect pests, and you read two books and a dozen articles to get a general background in this area. If the books and articles don't talk about your specific topic, you know you can't list sources in your "References" section unless you cite them. Does this mean you have to leave all those sources out of your final draft?

No. They've provided you with important background, and you need to point your readers to the key sources that will give them that background, too. Before you move into a discussion of your particular issue, summarize (in a sentence, a paragraph, a few pages, depending on the depth you need) the wider context of current knowledge relating to your issue. In that summary, cite the key sources, perhaps lumping a whole string of them together. That represents the background work you've done without occupying too much space in the thesis.

# CHAPTER 11

# USING GRAPHICS IN THE THESIS: TABLES, CHARTS, MAPS, PHOTOGRAPHS

## 11.1 Why Use Graphics?

While much of any thesis will consist of the words you write, usually a strong thesis will also make careful use of visual elements, recognizing that we process information visually as well as verbally. Visual tools can be as simple as white space on a page, setting off an indented list or indicating the breaks between sections of a chapter. **Illustrations** are more complex tools, divided into two categories and labeled as such: information (as numbers or other forms of data) organized into an array of rows and columns is called a **table**; any other illustration (a map, photograph, drawing, histogram, line graph or any other kind of chart) is called a **figure**. Illustrations can present data more economically than mere words, can show relationships more clearly, and can show the essence of complex data precisely and clearly.

Organizing your data visually is useful not just for your readers; it can also help **you** make sense of what you've found. In fact, many scholars **begin** writing by constructing their tables and figures. Once they know what their graphics show, they can figure out what else they need to say.

**Tables and figures for many writers and readers are the guts of the paper and must be able to stand alone**: In other words, they must make sense to a reader who turns directly to them without reading the surrounding text, as many readers of technical documents are apt to do. The caption or title must explain precisely and fully what is being presented. All key elements (x-axis and y-axis, rows and columns, etc.) must be clearly and fully labeled; make a legend or key if necessary. The table or figure must also be cited. See 11.6 for more information.

**At the same time, each illustration must also be tied into your text** by a reference to it at the place where the illustration is most relevant. Your reference may be parenthetical (Figure 1) or may be written into the text as below: "In Figure 1, the hourly averages for..."

## 11.2 Graphics Ordering Information: Two Examples

### 11.2.1 Example One

Mel Manalis and Jim Davidson have been using computerized anemometers to collect data on wind direction and speed at a number of sites on Point Conception; they have collected thousands of data points representing the average wind speed and direction for each hour throughout a year. Below are two ways they devised for representing these data: 1) a curve averaging wind speed for a site plotted against hours of the day for a given month, and 2) a

"wind rose," which shows average direction and speed for four-hour segments throughout the day.

**Figure 1**
**DIURNAL WIND SPEED VARIATIONS**
**BIXBY RANCH SEPTEMBER**


Each anemometer in the field is connected to a computer that continuously monitors the wind speed and direction.  The computer records average wind speed and direction for each hour of the day.  In Figure 1, the hourly averages for wind speed have themselves been averaged for each hour over a period of a month.  Figure 1 thus reports a typical day for the month of September, 1989, at each of the eight sites studied.  The graph for each site shows the mean wind speed for the month at that site.  The ordinate of the graphs (the vertical axis) indicates the wind speed in units of miles per hour (mph).

**Figure 2**

**DIRECTION AND DIURNAL WIND DISTRIBUTIONS**
**VIEW SITE, BIXBY RANCH, SEPTEMBER 1989**

The abscissa (the horizontal axis) indicates the time of the day using a 24-hour (military) clock. Hour 0 and Hour 24 represent the same time—midnight.

When you construct a graph, be sure to label what each axis represents, measured in the correct units. Since Figure 1 reports original data, there are no references. If you construct a graph to present original data you've collected, there will likewise be no references. However, if your graph represents data from another source, you will need to indicate the source. If you are photocopying or re-drawing an illustration from another source, **be certain to write your own caption, rather than repeating the caption used by the original source**; create a caption that focuses on the point you are using it to make. See section 11.6 for more citing information.

### 11.2.2 Example Two

Figure 2 presents a closer look at one of the eight sites, called the View Site, for the same month of September, 1989. You will notice that the mean wind speed is reported along with the diurnal variation in wind speed, as previously shown in Figure 1. However, in order to simplify a typical day, the 24-hour period was divided into six four-hour segments, defined on the abscissa of the diurnal graph (night, early morning, etc.). A "direction rose" is displayed for each four-hour segment on the figure; the different kinds of visual elements are defined in the **legend**. Each "pie slice" (triangular wedge) represents the percentage of time during that four-hour time segment that a particular wind direction occurred; the scale is given on the right-hand side of the rose in units of percent. The vectors ("sticks" or lines) represent the mean wind speed per direction, with the scale given in units of miles per hour on the left-hand side of the rose. (By convention, a stick or wedge pointing in a given direction indicates wind *coming* from that direction.) Summarizing thousands of data points in a way that reveals their patterns, these two figures together suggest the amount of data that can be represented in two dimensions in black and white.

Mel and Jim already knew that the wind speed increased in the afternoons, but these methods of presenting the data allowed them to discover a second peak at night— which raises interesting questions about wind dynamics in this region and in areas with similar topography and climate. This method of displaying the data may also be useful in fire control and prevention. For example, if a fire were to start in the study area, this record would allow firefighters to anticipate how wind speed and direction are likely to change throughout the day and night. If data similar to these were generated in areas like Santa Barbara and Los Angeles, the guidance they could provide might help prevent disasters on the scale of the 1990 Santa Barbara fire.

## 11.3 Using Graphics Correctly

You are encouraged to construct your own graphics, using data you have collected. If you find an illustration in one of your sources that you want to use—a map of the region you are studying, for example, or a table crammed full of data relating to your topic—you are encouraged to *adapt* it, redrawing the map to include only those features relevant to your topic, for example, or selecting from the table the most relevant data. If you decide to photocopy an illustration (a photograph, for instance, or some other key visual), *do not* include the caption and table or figure number provided by your source; write your own caption.

## 11.4 Other Forms of Tables

Tables generally consist of rows and columns of numbers, but they can also be useful for ordering and condensing all sorts of verbal information.  See Table 1, below, for an example of a non-numerical table.

**Table 1**
**Degrees of Protection for Spotted Owl Species and Expected Population Viability Linked to Projected Population Patterns (Reprinted for Salwasser, 1986).**

# 11.5 Using Graphics Imaginatively

Experiment with different ways of representing data.  See  Figure 3 below for a creative alternative.  This chart depicts a relational design wherein the data points are themselves the data.

**Figure 3**

Different types of information may warrant different types of graphics; different purposes for presenting the same data may also warrant different types of graphics.  As an example, consider the data presented in Table 2, below.

**Table 2**

The table provides exact numerical values for each of the projecitons; if exact values are important in making the point you want to make, the table is the best form for presenting the data.  Suppose, however, you're more interested in having your reader see the trends in the projections over time.   Figures 4 and 5 each graph some of the data from Table 2.  Look at all three illustrations and decide which shows the trends over time more clearly.  Which shows the information in the most comprehensive manner?

**Figure 4**

**Figure 5**

Figures 4 and 5 were created in less than half and hour in the Instructional Computing Lab using a graphics program called "Excel"; they were printed on a laser printer a t a cost of $0.50 each. These are just a few examples of the power your can tap into using visual resources; we encourage you to explore the graphics packages available to you.

## 11.6 Citing Tables and Charts

If you reproduce an illustration from a source, if you adapt an illustration from a source, or if you create your own graphic using data from a source, your illustration must include a citation of that source. Place the citation at the very bottom. You will also need to include a full reference to the source in your list of references at the end of the thesis, even if you cite it nowhere else.

If you have reproduced an illustration exactly, cite it as follows:

Reprinted from Author's Last Name (Date).
Example: Reprinted from Johansen (1984).

If you have adapted the illustration, cite it as follows:

Adapted from Author's Last Name (Date).
Example: Adapted from Flavin (1987).

If you have constructed the illustration to present data from a source, cite it as follows:

Data from Author's Last Name (Date).
Example: Data from Flavin (1987).

Tables must be numbered consecutively (Table 1, Table 2, etc.) from the beginning of your thesis; table number and caption are placed above the table; citation to the source (if any) is placed below the table. Figures are also numbered consecutively (Figure 1, Figure 2, etc.) from the beginning of your thesis; figure number and caption are placed below the figure; citation to the source (if any) is placed below the figure number and caption. Tables and figures are listed separately in the "Table of Illustrations" at the front of your thesis, behind the Table of Contents.

# CHAPTER 12

# WRITING THE THESIS

## 12.1 Getting Started

You may have found that each stage of this thesis project was hard to start—and hard to leave behind when it's time to go on to the next stage. That's normal for a research project of this scope. Each stage (formulating research questions, developing a research plan, gathering data, and so on) may present you with new and unfamiliar difficulties and may require that you develop new skills in order to get through it; the threat of the unfamiliar often leads us to avoid it. Cleaning the bathroom, for instance, may suddenly seem more urgent than tackling the computerized indexes in the library. However, once you do figure out how to carry out an activity such as gathering your data, it's always possible to see a need for more data, and to get stuck in data collection (or whatever stage you're in) for weeks or months.

This is especially true for writing. For many of you, writing is an activity filled with conflict. It may feel like a performance that you are in danger of failing. Even though you've written successfully enough in your academic lives to bring you this far, you may have vivid experiences in our past where your writing failed to meet a teacher's expectations and we never understood why. When you write, you may feel exposed on the page, vulnerable to criticism without being present to defend ourselves. This feeling can stop you from writing—especially when you have given so much of yourself to this thesis project. Or to protect yourself from that feeling of vulnerability, you may distance yourself emotionally from the writing you do, so you pretend that you do not care what happens to it. This emotional state (which Marx might analyze as the alienation of the worker from his or her work) makes it extremely hard to sustain the energy needed to actually write a document of the length you'll need to write for your thesis. Besides, it's not much fun.

You may find, therefore, that the work of writing this thesis surfaces a complex set of feelings and perceptions that you have about writing and about yourself as a writer, and you may need to come to terms with some of those feelings and work them through before you can get on with the task of writing. Even if you don't feel particularly conflicted about writing, you may need some specific tools or strategies to get yourself started or keep yourself going. Either way, the next section may offer you some guidance.

In addition to this manual, please carefully read Martin Maner's *The Spiral Guide to Research Writing* for help with narrowing your topic, generating an argument, writing a short plan, writing the rough draft, revising, editing, and many other aspects dealing with researching writing.

## 12.2 Strategies for Helping Yourself to Write

**1. Be aware of your feelings about the task and about yourself.** If you feel anxious or tense or frustrated or whatever, there's probably a good reason why you feel that way. Perhaps the

feelings stem from previous experiences with writing. You may find it useful to try to capture those feelings in words—to write them down—and you may be able to see how feelings that are blocking you from proceeding may not really fit the situation you're in now.

**2. Acknowledge that writing is hard and complicated work.** There may be some people who find writing easy. We don't know any. First-person accounts and research studies of professional writers, including academic writers like your professors, show that they often struggle with their writing—reworking what they've written over and over, making frequent and major changes in it, hitting dry spells, sometimes doubting whether they'll be able to finish (see, for example, Sommers, 1980; Elbow, 1981; Faigley and Witte, 1981). This manual you're reading was pounded out over a period of months, with numerous revisions both large and small. So if writing is hard for you, you're in good company.

**3. Start producing before you're ready.** Producing something in writing before you actually feel ready to write is often a good way to get moving, to "prime the pump" and tap your understanding of your issue. Here are several ways to do this:

> a) Focused "freewriting". "Freewriting" is a technique in which, for a limited period of time (say, 10 or 15 minutes), you write down everything you can think of as fast as you can. If you're a reasonably good typist, do it at the computer; if you're faster with a pen, do it on paper. As a way to approach writing the thesis, you can focus a different freewrite on each of the major issues or concepts with which you will be dealing. Since your goal here is to write quickly rather than carefully, the text you produce will probably not be good enough to put into the thesis. That's OK, since it only took you 10 or 15 minutes to write each freewrite. What you write will have value, however, as a first run at articulating what you know, at linking ideas together, and it may serve as a starting point which you can expand into a section of the thesis.

> b) Teaching your thesis research to a friend. Sometimes we find words for our ideas much more easily—and clearly—by talking rather than by writing. If you have a friend who is willing to listen to you and ask you questions, you may find it very useful to try to teach your research to that friend. One useful technique is to put each proposed chapter "in a nutshell"—to compress what you'll say into a sentence or two, and then to explain that idea more fully. Another useful technique is to take "code words"—specialized terms that are crucial in your subject area—and unpack their meaning. As you teach the core ideas of your thesis to your friend, you will probably say things you can then write down. Like the focused freewriting above, these are techniques that tap what you already know, sort of, but have not yet articulated clearly to yourself. (For more on these and other techniques, see Flower, 1989.)

> c) Use a draft/revision process to your advantage. If you know that most serious writing goes through multiple drafts with multiple revisions, you can focus your energy more usefully. If you start on a paragraph or a section and get hung up trying to get it just right, it may help to tell yourself that the first draft doesn't have to be good; it just has to be done. Once you've written a draft, even if some of the research is incomplete, the ideas unclear, the language fuzzy, you've at least got a scaffolding you can expand and modify later. If a particular part won't come, it may help to leave some blank space with a note to yourself in brackets about what you'll need to put in there, and go on to the next part that you're more ready to write. You can come back and fill in that part later.

**4. Use your outline but don't be hog-tied by it**.  You will probably produce a tentative outline by the end of the quarter.  Your outline will divide your thesis into logical chunks and provide a structure for each chunk.  As you continue to research, and even as you write, you may find that you need to revise your outline.  You may see new issues that you need to include; you may need to frame your issues differently or put them in a different order for greater effectiveness.  The outline is a tool to help you generate your document; it should change as your view of the document changes.

**5. Use time to your advantage**.  This means that you start writing early enough to have time to get stuck, to misfire, to dump whole sections and start over, and to go through the revision process that we're stressing.  It also means that you schedule regular writing time for yourself: blocks of time long enough (several hours) and close enough together (every day, or at least several days a week) that you can generate momentum and use it to keep going.  Whenever there's a long break in the process of writing a major piece like your thesis, you will need to use some extra time to get back into it, to figure out what you've done and what you need to do next.  Regular frequent writing will minimize such "down time."

**6. Set sub-deadlines for yourself**.  You have a couple of major deadlines—one for giving a full draft to your advisor, and another for handing in the final draft.  Working backward from those deadlines and using your outline, set for yourself "sub-deadlines" for each chapter or section you plan to write.  Give yourself a margin of error to cope with unexpected difficulties.  Breaking this large task down into manageable chunks and relating those chunks to the time you have available can make the difference between finishing without undue stress and panicked all-nighters.

**7. Shift modes of thinking**.  You will need to shift between various modes or ways of thinking—between, for instance, playing with ideas and working with them, between generating and judging.  For example, most writers move into a less critical mode when they are brainstorming ideas and generating new material, and into a more critical mode when they are revising and editing older material.  Some writers establish a daily rhythm, beginning a writing session by critically revising what they wrote the day before, then consciously shifting to a less critical, more playful frame of mind to produce new material.  You may also find yourself shifting your focus.  Sometimes you may focus your attention on the topic you are exploring, helping yourself define its elements, seeing their interrelatedness.  At other times you may be focus very clearly on the readers to whom you are attempting to communicate, asking yourself what they know, what they need to know, and how your information needs to be framed and presented to make sense to them.

**8. Get responses you can use**.  Get drafts out quickly, so there's time for response.  Give drafts to more than one reader: in addition to your advisor, give a draft to friends, roommates, anyone who is willing to point to parts they don't understand and make suggestions.  Perhaps you can arrange to exchange drafts with a couple of other Environmental Studies students.  Professional writers plan on getting feedback and using it to guide revision; you can, too.

# 12.3 Using Sources

Chapter 10 told you how to document sources; this section suggests how to use them, a much trickier issue. Your thesis will rely heavily on the work of others; all intellectual work does. Your problem is to use those sources without being **captured** by them. You might be captured by your sources in at least two ways: in content and in language.

Sometimes a thesis writer will discover a source that seems to provide all the information he or she can use; most of the resulting thesis would be based on that source. Or perhaps two or three sources cover different aspects of the issue, so that each chapter rewrites a different source. Such theses would probably fail, because they reflect inadequate work on the student's part. Relying on a single source is an error because no one source tells the whole story; often sources disagree, about questions of fact and about interpretations of fact. If they don't disagree, they may provide different slants, different contexts, different connections; or they may simply corroborate each other, which in itself is important information. If you only have for a single source for a major part of your thesis, you will need to look further and uncover a number of other sources.

In those very rare cases where only one or two sources dealing with your topic exist (or in those more common cases where you have been able to find only one or two sources, regardless of how many exist), you will need to reformulate your question to bring other points of view to bear. You may need to broaden your question, to examine it as an instance of a larger type. Or you may need to look for analogues in other locations or other systems. In any case, the thesis must **synthesize** different sources, bringing them together to shed light on your questions. Your questions are the center around which the thesis coheres; a good thesis will reflect your mind at work answering those questions through your sources, rather than simply repackaging a good source or two.

Sometimes a student encountering the work of a professional writer will feel the inadequacy of his or her own language: "that writer says it so much better than I could." The temptation here is to quote long strings (phrases, sentences, even paragraphs) from the source, with or without quotation marks. **Resist that temptation!** Even if the author said it beautifully, you will learn more in the effort to assimilate the source into your own language.

## 12.4 Incorporating Your Research Correctly

**Quoting, paraphrasing, and summarizing:** There are three ways of using the work of another: direct quotation, paraphrase, and summary. In good research writing, direct quotation is used very rarely, only when the language of the source itself is essential for the point you are making (as, perhaps, in a law enumerating a list of activities which are required or prohibited, or in a statement by a public figure which becomes part of a controversy) or when the author's statement is exceptionally clear or powerful.

Short quotations are, of course, enclosed in quotation marks, and they must be embedded within part of a sentence of your own, as in this example: "There are some who can live without wild things, and some who cannot. These essays are the delights and dilemmas of one who cannot" (Leopold, 1986, p. xvii). Longer quotations (of more than three lines) should be block indented five spaces and single-spaced. The block indentation indicates that it is a quote, so quotation marks should not be used:

Like winds and sunsets, wild things were taken for granted until progress began to do away with them. Now we face the question whether a still higher 'standard of living' is worth its cost in things natural, wild, and free. For us of the minority, the opportunity to see geese is more important than television, and the chance to find a pasque-flower is a right as inalienable as free speech. (Leopold, 1986, p. xvii)

A paraphrase, which is used a little more often than direct quotation, restates the ideas of the passage in the researcher's own words. By far the most common use of a source, especially in scientific and technical writing, is the summary, which condenses the relevant point into a few words: Leopold (1986) argues for the value of wild things. Often several sources which converge on the same point can be summarized in the same sentence: Keller (1987), Manalis (1988) and McGinnes (1989) all argue for the value of the senior thesis. Be sure to include transitions before, and explanations after the quotes. Explain why the quote is important and why you have included it, so the readers see the connection between your ideas and the ideas presented in the quote.

## 12.5 Editing

After you've written your draft of a major section, or of the entire thesis, and after you've reworked it until it says what you want it to say, it's time to edit it. Here are four principles we want you to follow:

**1. Edit "top-down".** This means that you attend first to those things that most affect readers, that determine how they'll work their way through your document, and whether they'll be able to find what they need to know. Review the titles (of the entire thesis, of individual chapters): do they convey precisely what the section contains? How about captions of illustrations, headings and sub-headings? Are the sections divided appropriately for the content you ended up with? Do introductions introduce what you actually wrote, or what you thought you'd write before you started? Do conclusions move beyond restating what preceded them? Only after you've fixed what you can at these levels do you move on to things that carry less weight with readers.

**2. Edit for precision.** In poetic writing, ambiguity is prized; a statement is valued if it easily means more than one thing. In contrast, in research writing—especially in scientific and technical fields—the opposite value holds: a statement is prized if different readers can easily agree that it means the same thing. In earlier writing classes, you may have been taught to avoid repetition, and you may have searched your mind and your thesaurus desperately for words you could use to replace a frequently appearing concept in a paper. However, for *this* kind of writing, repetition is not only acceptable, it's essential. Once you name an object or a concept precisely, repeat that name (or its acronym, if the name is made up of several words) every time you refer to it. If, for instance, you're talking about a "nuclear reactor containment vessel," your reader doesn't need to wonder if the synonym you thought up is really the same thing or not.

**3. Edit for conciseness.** If you can make your point in fewer words, do it.

**4. Edit for a "presentation copy."** This means cleaning up every surface error, and producing a draft with the quality of a professional presentation. This means running the spell check on your computer (which will catch perhaps 95% of your typos and misspellings). This also means

reading every page carefully to catch any grammatical mistakes, any remaining typos or misspellings, and any punctuation errors—and perhaps persuading a friend who is skilled in these areas to help you clean up your copy. Errors in grammar, punctuation and spelling do not usually interfere in communicating your meaning, but they *do* have a powerful impact on your credibility as a writer, especially in professional communication situations. Errors of this sort carry a social stigma; many readers see them as the mark of a careless writer—and a careless thinker.

# CHAPTER 13

# GRAMMAR, PUNCTUATION, AND STYLE

This chapter focuses on a few of the problems with grammar, punctuation and style that Environmental Studies students most frequently encounter. If you know that you have trouble with grammar and punctuation beyond the issues addressed here, a college handbook may help you. Please regularly use Diana Hacker's *A Writer's Reference* to help you with these areas.

One difficulty in using books such as the above is that you need to know when you are in trouble and be able to identify what the problem is in order to look up the right passage for a solution. Some innovative computer programs are being designed to address this difficulty. One such program is Right Writer, which will run your text through a "style checker" and identify passages that may show particular problems; you can then ask the on-line Strunk and White to define the problem and explain how to avoid it. Be wary of using computer grammar checks. Often, they will highlight correct sentences and pass over those with problems. Use computer programs, if at all, as an initial check, but do not rely solely on it.

## 13.1 What Is Grammar, Punctuation and Style?

**Grammar** refers to the patterns in which words are organized to make sense as sentences. Every language has its own grammar, its own rules for making sense; as a native speaker of your own language, you learned most of these rules around the time you were learning to walk, by listening to others and by your own experiments in speaking. You may not know how to describe these rules, but you know how to use them when you talk.

If your native language is English, you're already an expert in its grammar. Writing, however, creates some new problems for us: perhaps the biggest problem is the fact that with a written text we can't **hear** the rhythms, the emphases, the pauses, the changes in tone or loudness that guide us through the patterns of spoken language. These patterns have to be marked in some way on the page. **Punctuation**, along with capitalization, is a way to signal some of these patterns to the reader. Written language also differs from spoken language in that you don't have to spell words correctly when you speak. If you use a word correctly but misspell it, some readers (especially in the kind of professional communication situation that the senior thesis represents) will assume that you are either ignorant or careless and will see you as less credible.

**Style** is the way we write; Strunk and White call it "the sound...words make on paper" (66). Here are three ideas to consider about style:

1) Style varies from person to person. Some of us, for example, might prefer to load a text with every detail we can think of, while others might prefer to write the stripped-down, bare-bones version, just as some of us might feel more comfortable in jeans and a T-shirt while others of us might prefer to wear nylons or a tie.

2) We adapt our style to fit with different situations we enter, whether it is our style of writing or our style of dressing.  The Environmental Studies senior thesis is situated as a substantial academic research document, which calls for a clear and precise formal style a style that is not stuffy.

3) Some styles are both more pleasing and more powerful than others.  On this point Strunk and White offer much good advice.


## 13.2 Common Problems and How to Avoid or Fix Them

Below is a discussion of some of the most common problems that show up in the writing of ES students, along with some suggestions of ways to avoid or fix these problems.  Please see Hacker's *A Writer's Reference* for more detailed information.


**Affect/Effect:** Confusing these two words may be the most common writing mistake that ES students make.  It's easy to see how the confusion arises, since either sounds all right when the sentence is read aloud.  You just have to remember that in almost all cases, **affect** is the verb and **effect** is the noun.  Follow this pattern:

*The increase in vehicular traffic may **affect** the activity of the caribou, but it is too early for any **effect** to be visible.*

**Not:**

*The increase in vehicular traffic may **effect** the activity of the caribou, but it is too early for any **affect** to be visible.*

X **affects** Y when it **makes a change** in Y.  The **effect** is the change in Y that X made.

**Its/It's:** These two words are also often confused for each other, for the same reason:  they sound alike.  Furthermore, using the pair correctly **violates** a rule that applies with almost every other word.

**"It's"** is the contraction for **"it is"**; the apostrophe shows that a letter ("i" from "is") has been left out.  Since an apostrophe plus **"s"** is also the way to show possession, you might expect **"it's"** to mean "belonging to it"; it doesn't.  Possession for the word **"it"** is signalled by adding an **"s"** with no apostrophe.  Follow this pattern:

*It's unusual for this bird to leave its nest for long periods.*

**Not:**

*Its unusual for this bird to leave it's nest for long periods.*

**Data:** Like **media**, **data** is a plural word often mistakenly treated as singular.  (The singular is **datum**, just as the singular for **media** is **medium**.)  Therefore, say:

*The data **are**... or the data **show**...*

**Not:**

*The data **is**... or the data **shows**...*

**Comma Splices:** A comma splice occurs when you use a comma between two parts of a sentence that could each stand by themselves as complete sentences.  The sentence you're now reading has a comma splice, the part on each side of the comma could stand by itself.  Here are three ways to fix comma splices:

> 1) Divide the sentence into two sentences.  Thus:
> *These two sentences used to have a comma splice. The part of each side of the comma could stand by itself.*

> 2) Replace the comma with a semicolon, which is a stronger connector.  Thus:
> *This sentence used to have a comma splice; the part on each side of the comma could stand by itself.*

> 3) Add a connecting word after the comma.  Thus:
> *This sentence used to have a comma splice, because the part on each side of the comma could stand by itself.*

**Sentence Fragments:** A sentence fragment occurs when you write a string of words that looks like a sentence (begins with a capital letter, ends with a period or other end-punctuation) but cannot stand by itself and make full sense.  It may have subordinate subjects and verbs, but it does not have both a main subject and a main verb.  Often sentence fragments complete the thought of the full sentence just before them, so they sound okay when they are read out loud. The second "sentence" in the pair below is a sentence fragment:

> *Often sentence fragments complete the thought of the full sentence just before them, so they sound okay. When they are read out loud.*

> The easiest way to find such sentence fragments is to read your text sentence by sentence **from the end to the beginning**; the sentence fragment will no longer make full sense to you, unsupported by the sentence in front of it.  The easiest way to correct such fragments is to connect them to the sentences just before them.

**Active and Passive Verbs:** Hacker mentions that "active verbs express meaning more emphatically and vigorously than their weaker counterparts  -- forms of the verb *be* or verbs in the in the passive voice" (111).  Any form of the verb *be* (is, are, be, am, was, were, being, been) "lack strength because their subjects receive the action instead of doing it" (Hacker, p.111).

> **Be verb-** A surge of power *was* responsible for the destruction of the coolant pumps.

> **Passive**- The coolant pumps *were destroyed* by a surge of power.

> **Active**- A surge of power *destroyed* coolant pumps.

See Hacker pg. 111-112 for more information about when to replace and when not to replace anny form of the verb "be" in sentences. As a general rule, avoid using any form of the verb if possible.

**Lack of Parallel Construction:** Parallel construction is simply a matter of putting the same kinds of information into equivalent or "parallel" grammatical forms. It makes complicated sentences easier for readers to track. Consider these three sentences:

- Monitoring had three goals: to determine whether groundwater became contaminated, finding if run-off carried contaminants off-site, and it also recorded changes in air quality.
- Monitoring had three goals: to determine whether groundwater became contaminated, to find whether run-off carried contaminants off-site, and to record changes in air quality.
- Monitoring had three goals: determining whether groundwater became contaminated, finding if run-off carried contaminants off-site, and recording changes in air quality.

Both the second and third sentences put the information from the first sentence into parallel grammatical structures. Each is an improvement over the first.

**Misplaced Modifiers:** The most common problem with misplacing modifiers is that in the structure of English grammar, a describing phrase at the beginning of a sentence modifies or describes the grammatical subject of the sentence. Consider the two following sentences:

- Hoping to hold down energy costs, **garbage** [subject] has been explored by local governments as a source of electricity.

- Hoping to hold down energy costs, **local governments** [subject] have explored garbage as a source of electricity.

In both sentences, the opening phrase (Hoping to hold down energy costs) modifies the subject of the sentence. However, **garbage** has no interest in holding down energy costs; only in the second sentence is the right term in the subject slot.

**Wordiness:** Strunk and White's most famous advice is "Omit needless words." Enough said.

# CHAPTER 14

# WRITING AN ABSTRACT: PRINCIPLES AND EXAMPLES

An abstract tells readers the essence of your thesis, in 200-250 words. The abstract must do the following:

- contain the title of the thesis and your name in full,

- state briefly the research problem, question or hypothesis,

- describe the methods and procedures used in gathering data or studying the problem, and

- give a condensed summary of the findings and recommendations of your study.

If your study produced any numbers, the most important ones should appear in the abstract.

Most readers of abstracts are looking for documents that are relevant to their own research; thus they will skim your abstract among many others. As you write the abstract, keep in mind the rapidly reading researchers skimming for materials relevant to their projects; identify your topic, research ideas and methods, and conclusions clearly and precisely by using **key words**.

The abstract is not the place to tell about your experience writing the thesis, your uncertainties, struggles and successes or failures; if you want to talk about your own process, put it in a preface or use it to explain the help of the people you thank in your acknowledgements section.

Throughout your entire thesis every word should count; in the limited space of the abstract, it's even more important to be precise and concise. If you know you tend to be a little wordy, write a 400 word abstract and then go through it sentence by sentence, mercilessly cutting it in half.

While the abstract appears at the front of your thesis, it should be one of the last things you write. An example is available in Appendix A (A-2).

# CHAPTER 15

# DISTRIBUTING YOUR RESEARCH RESULTS: WHAT'S NEXT?

As you approach the end of your senior thesis project, you can congratulate yourself on your accomplishment. But your work doesn't have to molder on your shelf after your thesis is accepted by the Environmental Studies Program; you have developed a measure of expertise that you can share with a wider range of people. This process of distributing research results is the justification for society supporting research institutions like ours. Here are at least four ways you can distribute your findings:

1) You will probably want to have a copy to show to potential employers. This may be self-promotion more than it's distributing your research findings, but it does show what you've learned.

2) Depending on your topic, you may be able to identify local organizations or individuals—conservation groups, perhaps, or environmental planners—who could use your findings and who would want a copy of the thesis.

3) A range of publications might be interested in publishing your thesis—in its entirety or somewhat excerpted and condensed. One publication to consider is Discovery, the UCSB journal of undergraduate research. Scheduled to come out once a year, Discovery is looking for good research reports of at least 20 pages written by UCSB undergraduates; information on how to submit is provided in Appendix B. Your advisor may be able to suggest other appropriate possibilities for publication.

4) A greatly condensed version of your findings and recommendations might be of interest to a great many people. Do you have material for a guest column in the Nexus or your hometown newspaper? Does your thesis develop policy recommendations that legislators would benefit from hearing?

As you finish your thesis, you may feel that it is less like a neatly wrapped package and more like a house full of spaghetti, with strands leading off in every direction. That's a normal feeling at the end of a major research project. You have developed an understanding of an issue in such depth and detail that you see how it's connected to many other issues, and therefore multiple paths for further investigation have unfolded before you. It may well be that the most important use of your research project is the effect it has on you, as it pushes you down some of those paths in the future. If so, we wish you well as you continue your inquiries.

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# APPENDICES

# APPENDIX A
# SAMPLES

## SAMPLE TITLE PAGE

UNIVERSITY OF CALIFORNIA
Santa Barbara

AN OVERVIEW
of
ENVIRONMENTAL COMPLIANCE REQUIREMENTS
for
A NATURAL GAS TREATMENT FACILITY
in
SANTA BARBARA COUNTY

Detailed Thesis Outline
and
Annotated Bibliography

Prepared by:

July 5, 2001

Thesis advisor:

position

affiliation

# SAMPLE PAGE FOR ABSTRACT:

ABSTRACT

The Reconstruction of American Commercial Structures,
1929-1939

by

David Ellingsen Fox

(Begin typing the abstract here.)

# APPENDIX B
## FORMS FOR SUBMITTING YOUR WORK TO <u>DISCOVERY</u>

# APPENDIX C
# LIBRARY AND REFERENCE RESOURCES