

ABSTRACT

Title: THE ECOLOGICAL ECONOMICS OF
SUSTAINABLE TOURISM; LOCAL VERSUS
GLOBAL ECOLOGICAL FOOTPRINTS IN
VAL DI MERSE, ITALY

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Tourism has been proposed as an important tool for sustainable development, yet decision-makers lack appropriate measures for its economic, social, and environmental success. "Sustainable tourism" implies a finite limit to tourism growth beyond which point it is no longer sustainable, yet to date, benchmark environmental indicators have not been developed to define a destination's carrying capacity. This dissertation utilizes concepts from ecological economics towards defining a sustainable scale for tourism development. In addition, an ecological footprint indicator (EF) is applied to two populations (residents and tourists) responsible for both local and global environmental pressures. These distinctions are important because traditional concepts of tourism carrying capacity focus solely on impacts to the host destination. This creates the possibility that tourism activity viewed as locally sustainable is still causing impacts elsewhere on the planet. By widening the scale of the ecological footprint, I quantify and discuss the differences between local and global environmental pressures of tourism.

Proponents of "alternative tourism" (agrotourism, ecotourism, bicycle tourism) have suggested the Merse watershed in Tuscany Italy be developed to absorb tourist overflow from crowded city centers. My findings are that combined local activity of

host and visitor populations does not exceed (in terms of ecological footprint) the biocapacity calculated for Val di Merse. However, biocapacity for Val di Merse is exceeded when arrival transport to the destination is included, with tourist equivalent resident EF rising from 5.36 to 38.15 gha/person. I conclude that tourism frequently is declared locally sustainable without examination of its impacts at a global level. In response, I propose an alternative conceptual model which provides a foundation for knowledge management across multiple spatial scales. Local policy strategies for tourism are explored using conceptual models, and analysis of both eco-efficiency, and the area's tradeoffs in greenhouse gas emission inventory.

THE ECOLOGICAL ECONOMICS OF SUSTAINABLE TOURISM; LOCAL
VERSUS GLOBAL ECOLOGICAL FOOTPRINTS IN VAL DI MERSE, ITALY

By

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Preface

There was no telling what people might find out once they felt free to ask whatever questions they wanted to.
-Joseph Heller, *Catch-22*.

There are numerous ways to assign merit to academic work; one is critical rational assessment of empirical analysis. Those who are not inclined stray from this strategy will likely be disappointed by this dissertation, in that it takes the form of a *dialectic*. Designed less to evidence experimental data, broadly speaking, a dialectic is an exchange of propositions (theses) and counter-propositions (antitheses) resulting in a disagreement. The aim of the dialectical method, is to try to resolve a given disagreement through rational discussion.

This approach was motivated by a need to address the following paradox: while enrolled in a PhD program to study the environment, society, and sustainability, my annual ecological footprint averaged 23 hectares (compared to 12 hectares, the average ecological footprint of a U.S. citizen). Worldwide, there exist 1.8 gha/per person. If everyone consumed the energy and resources I did during this period, we would need 13 planets to support us. A *Catch-22* of this sort almost warrants some sort of apology in advance, as the means available to deal with such circular logic often turn out to be as unsatisfying and incomplete for the reader as unsettling for the writer.

A "dialectic" isn't a means to escape 'the catch', but can help us examine our understanding of how we can or should perceive the world (epistemology), an assertion of the interconnected, contradictory, and dynamic nature of the world outside our perception of it (ontology), or a method of presentation of ideas or conclusions (as employed by Kant, Marx, Hegel, Plato, etc). While the aims here are of an entirely more humble nature, the approach used here is similar in that it focuses on the (dialectical) relationship between the "whole" (or totality) and the "parts", simultaneously independent and participating in feedbacks. It is one strategy for how one might reconcile their place in social/ecological systems, and the ecological pressure they present, for better or for worse. This back-and-forth (dialectic) of causation implies a dynamic process central to characterizing human ecology, yet whose examples remain rare in ecological economics.

I chose to present my dissertation in this manner for two reasons. First, I wanted to call attention to two issues I thought would be increasingly prominent in the next 100 years, ultimately influencing both the length and quality of human existence on the planet (those being a) air travel and b) sense of community at a global scale). Second, beyond contributing a quantitative study of tourism impacts, I wanted to relate that

information to the broader and recurrent challenge of conceptualizing what is sustainable, for how long, and for whom. In doing so I wanted to call attention to how we structure our ideas of “the problem”, noting that our tendency to polarize issues detracts from our abilities to recognize underlying drivers and reach more efficient means of problem resolution. Which is to say, I believe these are more than just technical problems and as such they deserve more than just technical examinations as we identify possible solutions.

Resolution to ‘the catch’ or paradox can only be found when one transcends a scientific tendency to divide the problem from solution, and ones self from the system. For many scientists, this is something very hard to accept, and I acknowledge that not all will find such strong flavor either palatable or complete. Therefore, I thank-you for your patience.

Dedication

For my dad, Norbert E. Patterson.

Acknowledgements

*...most people think of it in terms of getting;
success however, begins in terms of giving.*
-Henry Ford

I thank these highly successful groups and individuals:
My family, members of the Gund Institute, University of Siena Department of Physical Chemistry and Biosystems, Villaenima, Thinktank le Vaudreuil, the University of Maryland Ecological Economics Student Group; river communities of the Noce, Limentra, Potomac, Salmon and Dora Baltea.
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Chapter 1: Introduction

*“An unresolved theological controversy concerns
how many angels can dance on the head of a pin?
It turns out that the answer depends on the size of the
pin relative to the size of the angels.
Or does it? What if more and more angels
can squeeze in less and less space?
After all, angels are squeezable.”
-T.Panayotou*

Harvard environmental policy analyst Theodore Payanotou, once challenged his audience with a question coincidentally posed by Joseph Heller in *Catch-22*: “How many angels can dance on the head of a pin?” He shrugged replying “After all, angels are squeezable.” (Panayotou 1992). His point was that humans assign numbers and units in attempts to give concrete measure to something, even when those numbers refer to something still ambiguous. Similarly, environmental scientists concerned with the state of human life support systems, population projections, material/energy use, waste emissions and the relative status of other species on the planet, run into problems when they employ environmental indicators to help distinguish between what is sustainable activity, and what is not. Some suspect that much ambiguity can be explained because even in the most controlled of situations, the way we employ indicators (like angels) is well-*squeezable*. Joy Hecht, author of *National Environmental Accounting* (2005) and former board member of the US Society for Ecological Economics remarked in a panel discussion of the society “Wouldn’t it be odd if we found that activity which we

calculated to be sustainable at one scale turned out to be entirely unsustainable at another?...In theory, its very possible, but nothing we've ever really explored" (Hecht 2001).

In great part whether an activity is deemed sustainable or not has to do with the extent its impacts can be measured and/or considered relevant. "Cradle to grave" seems straightforward enough for materials, yet the rules of accounting seem incomplete when applied to human activity. These indicators tend to be place based, while humans are mobile, long-lived, and globalization brings increasing impacts far removed from study areas. The further a policy maker's "realm of concern" extends beyond the bounds of their jurisdiction or beyond the present generation, the more difficult it becomes to make that explicit. This is problematic because unlike angels, one human's dance upon the planet inevitably affects the dance of others. In a globalizing world, it is important we learn more about what indicators can tell us when we define, scale up or down, or press upon these boundaries. As societies widen their scope of concern for others who share their terrestrial fate, more information will be needed about how one's activity affects others from local to global scales. As Hecht points out, we don't know enough about how sustainability indicators perform when assigned this task.

This dissertation focuses on a set of questions posed by local authorities in the Province of Siena, Tuscany Italy who requested reporting on the state of sustainability of their tourism industry in the rural watershed known as Val di Merse. While the current state of knowledge and understanding of tourism impacts inclined them to consider local impacts,

I take an ecological economic approach and extend these concerns to the global scale. The questions considered are 1) do tourists consume and produce waste locally at similar or different levels to residents? 2) is the total population of residents and tourist local activity within the bounds of what the territory can assimilate and/or produce? 3) are the global impacts of that activity still within those bounds? 4) how does rural tourism to compare to other industries in Val di Merse, and how does Val di Merse compare to other tourism destinations? 5) what might be some strategies to keep local and global tourism industry impacts in Val di Merse within the bounds of what the territory can produce/assimilate? Quantitative comparisons of local and global impacts are important because they help us understand the “realm of concern” of sustainability efforts. Without consensus on this scope, decision-makers lack information critical to discerning effective targets and interventions.

The outline of the dissertation is as follows:

Chapter 2 presents a review of tourism and sustainable tourism in terms, research and definitions. It also includes a review and description of how one goes about calculating the ecological footprint.

Chapter 3 describes the *ecological economics* of tourism, detailing some of the problems with conventional economic theory in its ability to support a tourism which does not erode the natural capital which supports it.

Chapter 4 presents a qualitative review of case study area: Val di Merse in Siena, Italy. As described in Chapter 3, the ecological footprint is not a complete measure of sustainability; this chapter complements the quantified approach provided by the ecological footprint methodology. It discusses demographic shifts, local perceptions of biodiversity, eco-cultural knowledge, and cultural homogenization. This is important background information because these factors influence how a destination is able to assimilate tourism and tourism related impacts.

Chapter 5 discusses the “local ecological footprint” of tourism in Val di Merse. It provides a quantified comparison of local impacts of two populations, the resident, and the tourist. Tourist presence is converted into statistics of “equivalent population”, so it is possible to compare the consumption and environmental pressure used by a tourist, to that of a resident. This dissertation makes a technically unique contribution and differs from previous studies by 1) using direct data collection from tourists, rather than relying on civil estimation of local travel, purchases, and activities; 2) dealing with a contiguous area, rather than an island while also dealing with other modes of arrival which includes airplane, train, and automobile; 3) being the first study of this sort to be done in an industrialized country, and in an area where

‘ecologically friendly’, or agro-tourism is the primary motive for travel; 4) being the first ecological footprint where a direct and quantified comparison is made between tourists and residents; 5) being the first ecological footprint of tourism where the biocapacity of the area is known, and therefore is it possible to consider whether the area in question is able to support the additional tourist consumption; 6) being the first ecological footprint of tourism where waste production is considered; and 7) being the first ecological footprint where tourist impact is quantified and subtracted from the amount normally attributed to residents.

Chapter 6 covers the significance of the “global ecological footprint” of tourism in Val di Merse. It illustrates why using the *local* ecological footprints as a “tourism carrying capacity” fails to account for important environmental pressures at the *global* scale. This chapter also presents an eco-efficiency analysis, which is to present a picture of some of tourism’s benefits (ie revenue) versus some costs (i.e. CO² emission), compared to other destinations and other industrial sectors.

Chapter 7 summarizes the relevance of global versus local ecological footprints and discusses the importance of one particularly difficult impact to control at the global scale: airline emissions.

Chapter 8 extends the relevance of the previous chapters to the difficult issue of “realm of concern”. It explains how one obstacle to addressing this issue fully is the polarization which occurs between those concerned with the impact of tourism on

climate change, and those concerned with the impacts of climate change on tourism. This chapter presents two conceptual models relevant to tourism and climate change knowledge management.

Chapter 9 is a summary list of contributions of this dissertation, and an outline of future research possibilities. In a globalizing world, tourism increases connections from formerly isolated destinations to global-level trends (e.g. consumption/ growing demand for energy and material resources, contributions to global warming and loss of biodiversity). This dissertation stresses the need for both indicators and institutions and indicators to meet the challenges presented by addressing sustainability at multiple scales.

Chapter 2: Review of Terms and Case Study Overview

*The voyage is like a science, grand and grave,
which reports to us of our own identity.*
–A. Camus

We are all visitors once we venture beyond our horizons. As travelers, we may have lofty goals: to know and appreciate more about the world, other cultures, languages and species. We are often intent on improving our own lives, and sometimes those of others. Foreign travel also revives parts of our psyches which lie dormant in our everyday lives, nurturing feelings of personal liberty through unfettered mobility. Tourism is often assumed to be a benign and ‘smokeless’ industry that brings needed economic growth to isolated areas, yet few scholars have seriously studied its ecological and social impacts, nor the ways such costs are distributed.

A certain measure of our ignorance about tourism’s impact can be explained by the fact that it is an activity in that is difficult to analytically discern from ‘normal life,’ even for those who specialize in its study. Most analyses on local impacts of tourism have been limited to areas with extreme cultural contrasts, permitting easier differentiation between host and visitor impacts. In reality, tourism research is a participatory and subjective activity. Tourism is an industry which we might know better, if only we did not know it so well.

Once an activity limited to the cosmopolitan elite, rising incomes, greater leisure time, and advances in transportation technology fostered a tourism boom in the decades after WWII (Amelung 2002). Since that time, international tourism has grown at a rate of 5 to 8 percent to 698 million international arrivals (WTTC 2003; WTO 2001). Tourism has become a defining force in popular culture for most developed countries; the United Nations now considers tourism and paid holidays a corollary to the universal right to rest and leisure¹.

Tourism is an important industry in almost every region of the planet, touching the lives of most of the world's population, and employing one-twelfth of all workers. As the world's largest single industry (WTO 2003) the travel and tourism economy contributed US\$3.5 trillion in 2000, amounting to over 11 percent of the global GDP, and 9 percent of all capital investment. The industry is expected to create 5.5 million new jobs worldwide by 2010 (WTTC 2003).

Tourism has long been identified as a powerful tool for development, due to faith in its ability to deliver 'win-win' outcomes for tourists and host communities alike (De Kadt 1979; Woods 1994). The industry is believed to spur economic growth (Brau et al 2003), increase foreign exchange, enable smallholder investment, raise local employment, and to provide needed funds for conservation (Pearce 1981; Woods et al

¹ Guaranteed by Article 24 of the Universal Declaration of Human Rights and Article 7d of the International Covenant on Economic, Social, and Cultural Rights UNEP-IE (1993). Environmental Codes of Conduct for Tourism. Paris: UNEP, WTO (1999). Global Code of Ethics for Tourism. General Assembly- Thirteenth session 27 September. Santiago, Chile, WTO.

1994)). In many cases, this has led to improved environmental protection (Pigram 1980; Boo 1990) and social networking opportunities for isolated communities (Pearce 1981). Many scholars associate tourism with a unique ability to balance economic growth with natural and historical conservation, in poor and rural areas alike (Sonnino 2003; Bramwell and Lane 1994).

The concept of *sustainable tourism* was developed to apply these benefits to the most serious global problems: persistent poverty; increasing global inequality; global warming; and the depletion of non-renewable resources and biodiversity². This idea was initially proposed as a conservation tool in the 1982 Joint Declaration on Tourism and the Environment (Ceballos-Lascurain 1996). Nearly a decade later, participants at the 1991 Earth Summit then linked tourism to the goal of sustainable development, establishing the idea of *ecotourism*, and leading to a host of ‘new’ tourisms (e.g., green tourism, responsible tourism, heritage tourism, cultural tourism) (Chambers 2001; Poon 1993). Following Rio, international standards such as ISO 9000, 12000, 14000, and Agenda 21 were applied to tourism, and several certification schemes were designed specifically for sustainable tourism (e.g., Green Globe, AAA, blue planet, Eco-Guide).

All major intra-governmental organizations which address tourism (e.g., World Tourism Organization, United Nations, World Wide Fund for Nature, World Bank, European Union) have established definitions of sustainable tourism (IWGIST 1993;

² As outlined in the Brundtland Report WECD (1987). Our common future. Oxford, Oxford University Press., Agenda 21 UN (1993). Agenda 21: Programme of Action for Sustainable Development. Report of the United Nations Conference on Environment and Development, Rio De Janeiro. Volume I. resolutions Adopted by the Conference. New York, United Nations. **etc.**

WTTC 1992), yet exactly what this means in practice continues to be hotly debated (summarized by Sharpley 2000; Clarke 1997; Hunter 1997). Müller (1994) suggests that “sustainable tourism is the result of 5 interrelated goals: economic health, subjective well-being of the locals, protection of natural resources, a healthy culture and satisfaction of guest requirements.” Others have claimed the term is little more than a commercial mantra, lacking any real ability to deliver on promises of sustainable development (Hunter 1997; Schmidt di Friedberg 1997; Collins 1999) as cited by (Bimonte and Punzo 2004). These scholars doubt that current policies are adequate to achieve such ambitious goals (Hunter 1997).

While “strong sustainability” is implied in much of the sustainable tourism literature (Collins 1999), growing evidence indicates that most all tourism activity contributes to environmental pressure (Duffy 2001). Tourism often leads to changes in landcover, and the use of land, water and energy (Becken and Simpson 2002; Carlsson-Kanyama and Linden 1999), increases biotic exchange (including disease), leads to the extinction of wild species, and often changes perceptions and understanding about the environment (Gössling 2002).

In sustainable tourism literature, discussions of the appropriate scale for the industry are usually based on some conceptual variation of *local carrying capacity*, frequently defined as “the amount of tourism damage a site can assimilate without long-term damage – which can be measured against the total number of tourists using the site to determine whether the social optimum has been exceeded and the site is being over-

utilized” p32 (Steele 1995). Two principal strategies to stay within such bounds are found in the literature: *tourism concentration* (i.e., a small number of ‘sacrificial sites’ can provide needed conservation revenue), and *dispersion* (i.e., impacts need not become manifest, as long as tourists remain spatially and temporally dissipated) (Collins 1999).

Host communities may wish to expand their tourism sector, but lack quantitative measure of public environmental costs exacted for this expansion. Tourism development often proceeds rapidly, and economic booms often lead to population increases and a strained civil infrastructure. Secondary and often unforeseen environmental and social consequences can eventually permeate every aspect of a host community. In rural communities environment is often a principal contributor to local quality of life.

Section 1: Case Study Overview

In anticipation of certification as a UNESCO World Cultural Heritage site, the Province of Siena, Italy (3,800km², population 250,000) commissioned a report (SPIn-Eco 2002) to describe its twenty-three municipalities according to five indicators of sustainability: carbon dioxide balance, ecological footprint, natural capital, emergy, and exergy calculations. The information was to be used as an Agenda 21 benchmark for the European Union, and to inform the most pressing development challenges: congestion in the province’s historical center, a lack of rural employment opportunities, and inefficient resource use overall. The tourist industry,

having ballooned from 800,000 to 2,020,000 annual arrivals in the past seven years, was seen to be a key factor in each of these problems, overwhelming local infrastructure, and contributing to growing discontent among residents. As a result, two strategies were suggested to maintain economic growth: to tax tourist visits in the historical center; or to spread tourism development into Siena's rural areas. This dissertation concerns the second alternative.

Preliminary results of the SPIN-Eco report identified four municipalities to have an especially large surplus of renewable natural resources and under-used natural and cultural heritage sites. Provincial leaders suggested that the area known as the Merse watershed be developed to accept tourism overflow. This development would bring great changes to the Merse, an agrarian, forested valley (580 km²) with a population of 14,000, and little industrial activity. Some changes would be welcome: over the past fifty years, the increased mechanization of agriculture and declining profitability of the timber industry have led to sharp declines in local employment and abandonment of country homesteads. Yet Merse residents take exception to their rural townships being categorized as economically *depressed* (Patterson, 2002). Many proudly cite the Tuscan agrarian identity, social cooperation, and the natural resource wealth as an historic source of sustenance – even through the bleak war and post-war periods (*ibid*). Community members often debate whether these aspects of rural life would be threatened by the new development of tourism.

Agro tourism, nature tourism, and medieval ruins in the Merse watershed could all be developed to help accommodate Siena's visitors, but provincial administrators have lacked the ability to quantitatively confirm the tourism industry is delivering on its promise to deliver goods, services, and economic growth without eroding the area's natural capital. This raises many questions. First, tourists generally have a reputation for consuming more than the average host community resident. Yet, Val di Merse is attempting to offer a form of agricultural tourism which might deliver lower average consumption levels. Therefore, the first two questions that can be asked are: Who consumes more energy and material resources, a typical Val di Merse resident, or tourist? Next, if a quantification of this total consumption can be found, how does it compare to the energy and resources produced sustainably in the area? Third, because the economic activity results in impacts which take place locally and far from the case study site, once the distant impacts are included, can the same comparison be made? Lastly, what can be said about the choice of tourism in terms of impacts and income generated with respect to the other economic options available for these rural communities?

Tourism is now the world's largest and fastest growing industry, this question can be asked of communities in every corner of the globe. These are particularly relevant question because past answers to this question have inevitably relied on tourism's ability to generate profits and employment- seemingly overnight. However, the lure of this "fail-safe" path to economic growth is increasingly shadowed by a growing awareness of the ecological, social, and cultural costs paid in exchange.

Developments in ecological economics provide the conceptual framework to put this issue in new light.

To explore these questions, I use the *ecological footprint* methodology to define a biophysical carrying capacity for a rural tourism destination noted for the quality of its natural environment and abundance of “agro tourism” options. I compare the ecological footprint of an average resident to that of a tourist “equivalent resident”. By broadening the definition of impacts to include those that also take place at a non-local level, I use this new ecological footprint sum to compare the differences in impacts that tourism presents at a local and global level. I discuss the some options these differences present to tourism development planners. To facilitate discussion, I used a measure of tourism’s eco-efficiency to compare some aspects tourism’s costs (carbon dioxide emissions) to its benefits (local revenue).

Section 2: Terms and Definitions

The Destination Cycle

A key concept for tourism industry representatives, policymakers, and researchers is the *tourist destination cycle of evolution* (otherwise known as the *Butler cycle*). The destination cycle describes changes in tourism visitation volumes as a function of local tourism assets and the increasing popularity of a destination over time (Butler 1980) (figure 2.1). As impacts from tourism development become apparent (including crowding effects from increased arrivals), the appeal of a destination begins to erode. Gone are the vibrancy of the socio-cultural experience, and the appeal of an

ecologically healthy environment. As a result, growth in arrivals flattens, ultimately stagnating the local economy and producing a period of steadily decline (Butler 1980; Butler 1991). Barring effective mitigation or rejuvenation, a destination will ‘burn out’, as malignant development impinges on the locale’s natural and social capital which sustain positive experiences for visitors (ibid). Retrospective examination and restoration of tourism impacts on host communities and ecosystems are rarely successful (Pleumarom, 2001).

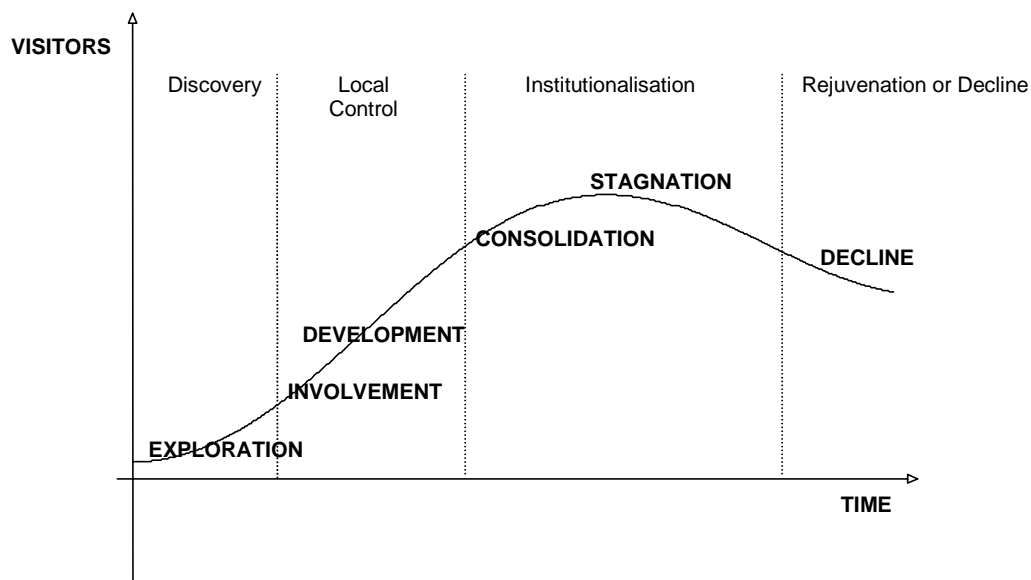


Figure 2.1: The destination life cycle, adapted from Butler (1980) in Amelung (2002)

Moreover, given those degraded resource bases and civil infrastructure requirements, rejuvenation costs are generally quite high (Butler 1980). Thus, even in conventional economic terms, destination stagnation is to be avoided. There is therefore significant and widespread interest in finding practical means of avoiding this dead-end (BA 1994; Garrigos Simon 2003; Furley 1996; Lindberg and Stankey 1997; Mowforth and Munt 1998).

Sustainable Tourism

The goal of indefinitely postponing the stagnation of tourism growth is for some the definition of sustainable tourism (McKercher 1993)³. For others (Smith and Eadington 1995; Hunter 1997), sustainable tourism must “meet the needs of the present without compromising the ability of future generations to meet their own needs” as outlined by the Brundtland commission (WECD 1987). According to Turner (1993), one’s position on these formulations depends on whether one believes that man-made capital can be substituted for natural capital. Others have noted an equally broad distinction between those who see sustainable tourism as an end in itself, and those who see tourism as merely a means to sustainable development (Amelung 2002). Some researchers suggest that “the industry is ‘hijacking’ the terms ‘ecotourism’, or ‘alternative tourism’” Clarke (1997; Collins 1999). Meanwhile others support a stronger critique, concluding that “most of the current sustainable tourism development cannot be genuinely conceived of as sustainable” (Collins 1999).

However, all of these critiques have one thing in common – they conceptualize sustainable tourism on impacts to local environments only. As I will demonstrate in the following sections, this is a critical limitation, which prevents the extension of our understanding of sustainable tourism to the global scale.

³ This is similar to Turner’s (1993) demonstration that to the majority of economists, sustainable development is evidenced by non-declining consumption per capita- or per unit of GNP

For the purposes of this study, a *lifecycle approach* to tourism impacts accounts for all activities from the time tourists leave their home countries until when they return (Patterson 2003). Most attempts to track the impacts of tourism focus solely on the local environmental burden of tourists at their travel destinations. While the lifecycle approach implies that all environmental burdens are accounted for, transport to and from the destination has yet to be included in such analyses. For example, even although British Airways claimed to be ‘pioneering’ in their a ‘lifecycle analysis’ of tourism, they however excluded the impacts of the transportation needed to carry visitors to and from their destinations (BA 1994). Identifying the tourism industry’s global effects – in ways which are locally meaningful – would be an important and innovative contribution to current conceptualizations of what is ‘sustainable’ about tourism and what is not.

Section 3: Footprinting of Tourism, a Review

The Ecological Footprint (EF), introduced by W. Rees and M. Wackernagel in 1996, is a synthetic indicator of environmental sustainability that is able to estimate the “load” imposed by humans on global ecosystems (Rees and Wackernagel 1996).

The EF of any defined population (from a single individual to that of a whole city or country) is defined as the total area of ecologically productive land and water ecosystems (forests, cropland, grazing land, built-up area, sea) required:

a) to supply, in a sustainable way, all the resources used and

b) to reabsorb, in sustainable way, all the emissions produced.

wherever on the Earth that land and water may be located.

Since areas are scaled according to their capacity to produce biomass, area units allow the comparison of the EF of different areas, with different countries and with the world average biological capacity available per person. The minimum requirement for global sustainability is that humanity's footprint must be smaller than the biosphere's biological capacity. Rough (under)estimates confirm that globally, humanity presents an overshoot: i.e. if everyone enjoyed a North American standard of living this would require three earths. Since we have only one earth, we are living beyond our biophysical means.

This environmental accounting methodology is recognized as one of the more interesting tool that attempts such an integrated resource accounting and it has stimulated a great deal of public attention, although there are ongoing debates about specific methods for the calculation. The journal of the International Society for Ecological Economics "Ecological Economics" has documented these debates in a special issue on the matter (Rees 2001).

Attributes of the Ecological Footprint

As with any sustainability indicator, the strengths and weaknesses of the EF approach become more apparent with use (see reviews in van_den_Bergh 1999; Roth 2000; Troell 2002; Van den Bergh and Verbruggen 1999). Applying the EF to tourism

offers an opportunity to test the limits of each indicator, to identify gaps in data, methodology, and our general understanding of a sector or region.

As an analytical tool, the EF is tractable in a wide variety of settings, is rapidly advancing innovating in methodology and familiarity, and helps to focus attention on challenging issues such as resource consumption, distribution, and equity. The positive attributes of the EF tool are summarised in figure 5.1.

Figure 2.2: Strengths of the Ecological Footprint as an analytical device⁴:

- case studies and common methodology involving the EF are becoming increasingly detailed;
- the EF is easy to communicate effectively with stakeholders, managers, civic representatives and scientists;
- repeated EF analyses over time may tell us about the directionality of a system (i.e., whether aspects of a system are becoming more or less land and resource use intensive);
- international NGOs (e.g., WWF) are increasingly adopting the EF concept, as are many national and regional-level institutions; and,
- As an analytical tool, the EF focuses attention on consumption issues, placing the responsibility for change on the most wealthy nations and individuals.

Drawbacks of the Ecological Footprint

It should be stressed that any given EF value does not indicate whether resource loads on a given area are sustainable; rather the EF only describes the physical area

⁴ See also www.bestfootforward.com for a more complete review and response to ecological footprint strengths and weaknesses

necessary to support given use patterns (Roth 2000; Troell 2002). Regarding sustainability, other qualitative considerations – which are often less easily quantified – must be considered (e.g., socio-economic and cultural conditions – see Chapter 4).

The Ecological footprint does have drawbacks (Figure 2.3). As a global budgeting approach, the EF is not only static, but it is incapable of pointing toward specific solutions (Troell 2002). Moreover, current methodologies permit data aggregation, confounding our understanding of the relationship between tourism impacts and those of local civil and domestic use (Gössling et al 2002). Since EF assessments are typically implemented at the national level (based on the scale of available data), they remain an awkward tool to inform local-level tourism development (Deutsch et al. 2000). Direct surveys of tourists and local and provincial data collection could bring EF assessments one step closer to a “real” understanding of local impacts.

Figure 2.3 Limitations of the Ecological Footprint as an analytical device:

Intrinsic drawbacks:

- as a static index, the EF cannot reflect the dynamic nature of ecological or social change (Costanza et al. 1993; Folke 1998 as cited in Troell 2002);
- the EF is based on broad assumptions about the habitat necessary to maintain biodiversity , with no references to other necessary conditions;
- the component calculations of an EF lack transparency for general audiences;
- the EF does not address socio-economic and cultural considerations ; and,
- use of the EF as a place-based indicator almost always excludes travel or transport activities.

Drawbacks according to data sources:

- use of the EF is limited to scales for which there is abundant available data – mostly at the national and regional levels;
- the combination of consumption estimates and multipliers make the EF inappropriate for statistically rigorous comparisons among populations;
- the scale at which EF data is available are not border criteria for ecosystems; and
- EF analysis is only as good as the data which goes into it; tourism specific analysis is often difficult because impacts of tourism activity are hard to differentiate from those of local inhabitants.

The Ecological Footprint as Applied to Tourism

Most *place-based* footprint studies (i.e. dealing with population average consumption) exclude tourism altogether (WWF 2000). However, some Internet-based ecological footprint (EF) calculators (which enable *individuals* to assess their own impacts) account for the total number of hours spent flying in a year⁵. Assessments of tourism in Balears (a series of islands off of Spain's Mediterranean coast) (Murray Mas 2000) and Manali (northern India) (Cole 2002) are two place-based assessments which have included rough estimations of tourist consumption. However in the Manali case, foreign tourists were assumed to have the ecological footprint of an average Indian. The Balears study estimated hotel energy and water use to be the primary impact of tourists. Both studies excluded tourist transport. These studies are faced with the problem of aggregation error, as many tourism activities mimic those of local residents, thus making it harder to determine the marginal contribution of tourism to the total impacts.

⁵ See www.bestfootforward.com and <http://www.earthday.net/footprint/index> The Choose Climate website allows users to identify the carbon contribution of their flights (see <http://www.chooseclimate.org>).

There is some disagreement about how responsibility for EFs should be assigned. The International Energy Agency (1998) argues that tourism footprints should be assigned in entirety to the visitor's country of residence. However, the difficulty of quantifying consumption of citizens abroad makes this objective impractical. While Gössling et al., (2002) completed an EF for the Seychelles that did include arrival/departure transport, they also made broad assumptions about tourist behavior at the destination which produce large margins of error (Gössling 2003 pers. comm.). Place-based studies of tourists' footprints (based on interviews and tourist-specific data) would improve our understanding of tourists' actual impact on local biophysical and social systems.

The Manali, Balears, and Seychelles studies each treated their relevant study areas as essentially an isolated islands to simplify data collection and additional calculations (Murray Mas 2000; Cole 2002; Gössling 2002). No EF studies of tourism in open, contiguous areas have ever been completed.

One reason why tourism has been excluded from ecological footprint analysis in the past is because of the difficulty of collecting data. For both theoretical and practical reasons, the EF can only address human activities for which quantifiable data exists, or can be readily obtained (Wackernagel 1994). Data on traveller habits in tourist destinations is seldom collected, precluding attempts to reconstruct after the fact (Becken 2002). For instance, the Province of Siena does not track the following: land-

based transport (especially at the Commune and Province level); airport arrival; mode of land-based transport; the sources of tourists' information about the Province (i.e., whether itineraries were planned before travellers left home, and whether the Province is able to influence tourist activity pre- or post-arrival); and the proportions of local vs. imported goods and services used by residents and tourists).

Most EF studies use input-output analysis, accounting for all materials and energy flows, which are then averaged for all local residents. For an example, the studies cited above use total energy consumed (i.e., electricity, waste, heating gas) in domestic and civil use, then divided among all residents (Murray Mas 2000; Cole 2002) Figure 5.2). Where tourist consumption is omitted, the host community's EF will be overestimated; this is especially the case for locales with larger tourism economies. Thus, there is clear need to establish a uniform EF methodology that would be capable of assessing not only the impacts of tourism separately from those of local residents, but which could also identify such factors in locales which are not "crisply defined" geographically (i.e., non-islands). To understand the tourist EF means to improve our understanding of the EF of local residents, as well.

Section 4: Standard Ecological Footprint Calculation

The EF considers six main categories of ecologically productive territory, based on the classification of the World Union for the Conservation.

- 1) *Energy land*: surface required to produce, in a sustainability way the amount of used energy. Wackernagel and Rees have also proposed an alternative definition based on the area of forest necessary to reabsorb the CO₂ created during the production of energy from fossil fuels. The two areas have the same order of magnitude, but the latter has the advantage to center the calculation of EF energy component on the problem of CO₂ concentration in the atmosphere and, by consequence, on the global warming issue.
- 2) *Cropland*: surface required to grow all the food and non-food (i.e. cotton, tobacco) products derived from agriculture;
- 3) *Grazing land*: surface required to produce the animal products. This includes all meat and dairy products as well as hides and wool;
- 4) *Forest*: area of modified natural systems dedicated to timber production.
- 5) *Built up area*: degraded land, ecologically unproductive, dedicated to localization of buildings, infrastructures, services, etc.;
- 6) *Fisheries*: marine surface required to support seafood consumption.

The formalism of the EF calculation considers a mutually exclusive use of these territories, in the sense that each territory is associated to only one activity: this is not exact but represents an acceptable approximation. EF is based on the assumption that most of the energy and material flows can be converted into the biologically productive area that is required to maintain these flows. It is measured in “global hectares” (gha); one global hectare is equivalent to one hectare of biologically productive space with world average productivity.

Calculation of the Ecological Footprint

Calculation of the ecological footprint was performed by the following steps:

1. The average consumption (C_n , expressed in kilograms per year) is calculated for each good (n) consumed by the residents of the region.
2. The surface area (S_n , expressed in hectares) necessary for the production of the specific good (n) is obtained by dividing the average annual consumption of the good (C_n) by its average annual productivity (p_n , expressed in kilograms per hectare year):

$$S_n = \frac{C_n}{p_n}$$

Recall that in accounting for EF surface area, the consumption of goods or natural services (e.g., systems needed to absorb wastes) are associated with a single area type. In the case of environmental services, the average productivity (p_n) must be considered as the quantity (in kilograms) of a polluting substance (n) that can be absorbed by one hectare of the associated area type.

3. The calculation of the ecological footprint (identified as F in these equations, expressed in hectares) is the sum of the contributions of the various surface areas (S_n) relative to all the n goods consumed:

$$F = \sum_n^{All\ goods} S_n$$

4. The calculation of the ecological footprint per capita (f , expressed as hectares per person) divides the ecological footprint total (F) by the population (P) of residents:

$$f = \frac{F}{P}$$

5. To calculate the global surface equivalent (E , expressed in global equivalent hectares), the areas of the six different area types are weighted by their average global productivity.

Calculation of Biocapacity

Biocapacity represents the total extension of ecologically productive land in a region, or the potential capacity to supply natural services starting from local ecosystems.

By comparing bio-capacity with EF (that gives us an estimate of the ecological services required by the local population) we can determine the so-called ecological deficits or surpluses, i.e. if the balance (the local supply of natural services minus the demand of the local population for services) is negative or positive. The presence of an ecological deficit indicates whether a region, in principle, is able to supply itself with local resources or it has to rely on “net imports of land”.

1. The first value is a calculation of the ecologically productive territories present in the region, examined in form of an extension (a_i), according to the six categories (energy, sea, arable land, pasture, forest, degraded surface).

2. To coherently compare biocapacity with the EF it is necessary to weight each area type (a_i) by their average global productivity. This allows the final value to be expressed in global hectare equivalent units (gha eq).
3. Following Wackernagel (1995), a 12 percent of terrain for the ecosystem is subtracted from each value, understood as the area which is indispensable for the preservation of biodiversity.
4. Summing the weighted areas (a_i) produces an estimated total biocapacity (similar to the EF). The sum of the separate areas of the six surface categories generates the total area (B) (measured in global equivalent hectares), thereby producing an estimate of the potential productivity of the region's ecosystems:

$$B = \sum_{i=1}^6 a_i$$

5. This value can then be divided by total number of effective residents to calculate the biocapacity per capita (b).

In this chapter, I reviewed Butler's concept of the destination cycle, and the various definitions of 'sustainable tourism'. Tourism ecological footprint attempts were reviewed, along with their strengths and drawbacks, and the final calculation of a standard ecological footprint was summarized.

Now that these terms and definitions have been covered, I turn in the next chapter to conceptual analysis. Namely, I cover issues of sustainable scale, efficient allocation, and just distribution in adopting an ecological economics approach to sustainable tourism.

Chapter 3: The Ecological Economics of Sustainable Tourism

*So convincing were those dreams of being awake
that he woke from them in a state of complete exhaustion,
and had to go straight back to sleep again..*

-Joseph Heller, Catch-22.

*Utility is when you have one telephone, luxury is when you have two, opulence is
when you have three - and paradise is when you have none. -Doug Larson*

This chapter describes the core concepts behind an ecological economics approach to sustainable tourism, and in doing so reviews why throughput reduction is necessary.

Ecological economists claim that neoclassical theory lacks justification of why economic growth should be strictly accelerated. However, while reporting on why it shouldn't (Daly 1996; Jacobs and Ropke 1999; Jacobs 1991; Myers 1997; Norgaard 1994; Redclift 1996), ecological economists have possibly found needs-satisfaction to be a difficult overhaul (Jackson, 2002). This chapter responds to this need by suggesting that the "rest and relaxation" image of tourism be employed to challenge or further explore the "more is better" mindset which also underpins many assumptions in consumption/utility debates of consumer theory. I also explain why tourism theorists believe that "sustainable" or "alternative" tourisms might provide insights to social vectors which could stimulate a reduction in economic throughput- a central goal to ecological economics.

The ecological economics approach is somewhat alternative to what is found in the tourism literature because of explicit treatment of total welfare as the result of

combined economic and non-economic (i.e., socio-cultural and ecological) welfare (Ekins and MaxNeef, 1992; Jackson and Marks, 1999). The ecological economic approach implies increased attention for the tradeoffs involved in treating one form of capital as fully substitutable for another. Further, considerations in ecological economics are particular because net social benefit can entail an increase in welfare for present and/or for future generations; consideration of social discounting is another difference between neoclassic and ecological economic approaches. The derivation of sustainable net social benefit in ecological economics is based on three essential principles: *efficient allocation*, *just distribution* and *sustainable scale* (Costanza et al 1997). Again, this is a departure from conventional thinking because until recently, most of the economic instruments used to define net social benefit were designed only to focus on the efficient allocation of resources (Common 1995).

Returning to our tourism example, we are reminded of the significance of the cost-benefit paradigm of neo-classical economics; namely, that net welfare is most rapidly increased by expanded economic growth. Tourism is well-known as powerful tool for rapidly spurring economic growth and foreign exchange. If welfare derived from economic growth is favoured over welfare derived from non-market contributors to quality of life (e.g., religious, agricultural, cultural aspects), a strictly neoclassical approach to setting limits on tourism visitation may not be maximizing net social benefit. An ecological economics approach is increasingly important in light of growing discontent with the negative impacts of tourism – which often persist despite positive economic performance. Following that, the next step is a facilitated

discussion on the overall scale at which tourism can be considered economically, socially, and ecologically sustainable. Ecological economics provides a theoretical foundation for such efforts. Sustainable scale, efficient allocation, and just distribution are treated respectively in the following sections.

Section 1: Sustainable Scale:

Beyond “More is Better”

Ecological economics has drawn special attention to economic throughput which exceeds sustainable scale (Daly 1991). Ecological economists often contest the neoclassical growth theory assertion that utility monotonically increases with consumption (Ramsey 1928; Cass 1965) and, as a consequence, with monetary wealth (Max-Neef 1995; van den Bergh et al. 2000; Siebenhuner 2000). Specifically, studies contradict the positive association between wealth and satisfaction (eg. “happiness studies” Kahneman et al. 2004; and by Cantril, 1965; Easterlin 1974; Argyle 1987; Veenhoven 1993; as cited by de la Croix 1998).

Throughput is a concept often used when ecological economists speak of sustainable scale. Defined as the flow of resources through an economy, in most industrialized nations throughput is greater than the biosphere can support in the long term (Princen et al. 2002; Arrow et al 2002). Such excess is often blamed on misplaced faith in conventional economic instruments/theory to prevent or reduce negative economic activity (Common 1995; Costanza et al 1991; Costanza et al 1997).

By some accounts, explanations for why growing consumption patterns have yet proved so seductive remain incomplete (Jackson 2002). Many neoclassical consumer behavior theorists admit most models of human agency cannot be empirically validated (Kocherlakota 1996; Campbell and Cochrane 2000; Smoluk and Vanderlinden 2004). The determination of utility is a subject of much debate; some the need for context (Frank 1989) that utility is the result of some combination of consumption level and other factors such as aspiration (Michalos 1980) comparisons with others (Hirsch 1977) and past levels of consumption (Dusenberry 1949; Scitovsky 1976; Brickman et al. 1978). The inter-temporal reference is of special concern to aims of throughput reduction, because existing models (eg van Valen's Red Queen⁶ 1973) applied to human agency (eg Abel's "catching up with the Joneses" 1990) often suggest that in a competitive world relative progress ("running") is necessary just for maintenance ("staying put").

Psychology's important contribution to the utility debate focused the argument on "habit", ie that repetition of a stimulus lowers perception and response to it. The implication is that the obligatory response to becoming habituated to a certain consumption level is to consume ever more. Wendner (2003), paraphrasing Scitovsky's (1992) work states "continuous comfort (ie. a constant level of consumption) leads to boredom, and stimulation (ie. consumption growth) is needed to relieve this boredom". Returning to our tourism example, we are reminded that similarly, luxurious holiday images often suggest that abundance, material fulfillment

⁶ This principle was proposed by the evolutionary biologist L. van Valen (1973), and is based on the observation to Alice by the Red Queen in Lewis Carroll's "Through the Looking Glass" that "in this place it takes all the running you can do, to keep in the same place."

of desires, even excess are primary motivators for tourists. Yet this model of consumption does not explain the growth in low-consumption, nature oriented tourism of a more quiescent nature. Moving beyond traditional consumption theories is a necessary step in coupling consumers with tractable, more sustainable, ways to consume. Used in this way, tourism studies are an example of cross-cultural opportunities which hold promise for tackling the ecological economic throughput challenge.

Tourism as a Social Vector

Tourism is the world's largest industry, and as globally pervasive, rapidly growing phenomenon- consumption trends in this sector exert a notable pressure on almost all areas of the planet (Gössling 2002a). The problems presented by excessive throughput are especially relevant to tourism, considering shared trends of tourism, consumption and globalization (Britton 1982; Shaw and Williams 1994; Mowforth and Munt 1998; as cited by Hughes 2002; and Gössling, 2002a, 2002b). Throughput trends have been explicitly recognized in tourism literature, and tourism experts have expressed some speculation that global and industry trends may be mutually reinforcing. Hunter (2002) notes: "global capitalism and its disposition tend to expand, rather than moderate tourist consumption." Meanwhile, in virtually all observed cases, on a per capita basis, the demands of tourism significantly surpass that of local and civil needs (Cole and Sinclair 2002). Studies of the "demonstration effect" suggest that in some host populations, local fashions and consumption patterns are influenced by those demonstrated by their visitors. As a result, host communities

are inclined to consume more (ibid; McElroy and de Albuquerque 1986). In addition, tourists are generally thought to consume more on vacation than they would at home (Akama, 1999).

In contrast, little examination has been made into the possibility of cases where tourists might be reducing their consumption on vacation. Investigating this possibility is important because as consumer behavior continues to drive the global economy towards increasing material throughput (Jackson and Marks 1999; Fine and Leopold 1993; Goodwin et al. 1997; Rosenblatt 1999) at increasing rates (Douglas and Isherwood 1980), precious few plausible social vectors for throughput reduction have yet been articulated. One particularly interesting facet of “ecotourism” ventures is the possibility that these activities can actually cause consumers to consume less, or that the attractive images associated with sustainable, healthy, country living, might bring tourists to emulate their hosts rather than vice-versa. Theoretically this is plausible because as tourism involves cross-cultural interaction, culture acts as both a ‘lens’ and a ‘blueprint’ (McCracken 1988). Some tourism theorists speculate that confrontation between consumer cultures might give consumers impetus for re-evaluating habits of consumption (Urry 1990). The reduction of global economic throughput requires special focus on the idea that economic systems (as organizations of production and distribution) and the resultant consumption levels are cultural attributes (Polanyi 1957). Tourism presents an important opportunity for cross-cultural interaction, measured comparison, and needed insight on the issue of culturally determined “wants” versus universal “needs”.

Section 2: Efficient Allocation

Market versus Non-Market Values

In microeconomic theory, producing an extra unit of a good should occur only when the added benefit of that extra unit exceeds the additional cost incurred in its production. Economists refer to this in the form of the equation $MC = MR$, or marginal cost as compared to marginal returns (Daly and Farley 2003). The theory acts as a “when to stop” rule, halting the expansion of production when costs exceed benefits. Applying this microeconomic theory to the tourism economy, tourism growth would be expected to stabilize before it became harmful to a destination (i.e., unsustainable).

As Daly and Farley have pointed out (ibid) there are several reasons why the “when to stop rule” is not used to identify a point where growth becomes detrimental for the macro-economy, or by extension, the tourism economy. The decision to expand tourism relies heavily on analytical tools used to gauge net social benefit and to perceive the impacts tourism can have on a given destination. In general, increased tourism arrivals should be pursued by public policy if they are believed to increase the net social benefit of the community at hand⁷. Differences exist between a neoclassical economic approach and an ecological economic approach in assessing the net social benefit derived from tourism.

⁷ The definition of community is important and will be discussed more extensively in chapter 8. As noted in chapter 2, commonly sustainable tourism initiatives focus exclusively on tourism at the local level, ignoring community obligations at broader scales.

The importance of seeking indicators of success beyond economic growth is underscored by the realities of contemporary tourism development. In market-driven economies, transactions favor values realized by the market, or through individual actors (for example, labor, property, or amenity values) over those represented by non-market, or socially collective attributes (for example, ecosystem services (Daily 1997) or domestic production (Waring 1988)). Those choices which might produce profits more immediately tend to take priority over those assets and investments which could support future generations (e.g., topsoil, fisheries)⁸. A claim made by ecological economists, is that favoring market values in this way reduces the likelihood of controlling economic expansion before it infringes on the non-market values which also support net social benefit.

If this claim is correct, governments eager to stimulate employment, foreign exchange, or investment are likely to decide to expand tourism to unsustainable levels. One study in Dominica has already documented such choices having unintended consequences for collective or non-market goods and services (Patterson and Rodriguez 2004). An example such as Dominica shares many common characters with Val di Merse, the case study presented in this dissertation. In many destinations which specialize in ‘sustainable’ tourism, quality of life for residents has traditionally drawn on a wealth of natural, social, and cultural capital, typically shared by relatively few local residents. Non-market resources are especially important in the

⁸ see Daly and Farley, 2003 for a complete discussion of discounting

daily lives of community members and they are therefore well-inclined to incorporate these factors into discussions on industry or economic limitations.

As mentioned before, an important difference between a neoclassical economic approach and an economic approach is the degree of substitutability between different forms of capital. The analytical framework described below (figure 3.1) is based on three lines of ecological economics reasoning – the first two relating to natural resource systems, the third to the social resource system. These are complimentary factors which support residents and are often critical to a locale's desirability as a tourism destination. Systems which have been historically persistent (i.e., remaining functional for decades or centuries) can be assumed to be mutually reinforcing (Pimm 1984). While this framework may not offer a comprehensive assessment of all associated costs and benefits of social and natural systems, it provides three lines of reasoning which can be applied to other sites and situations.

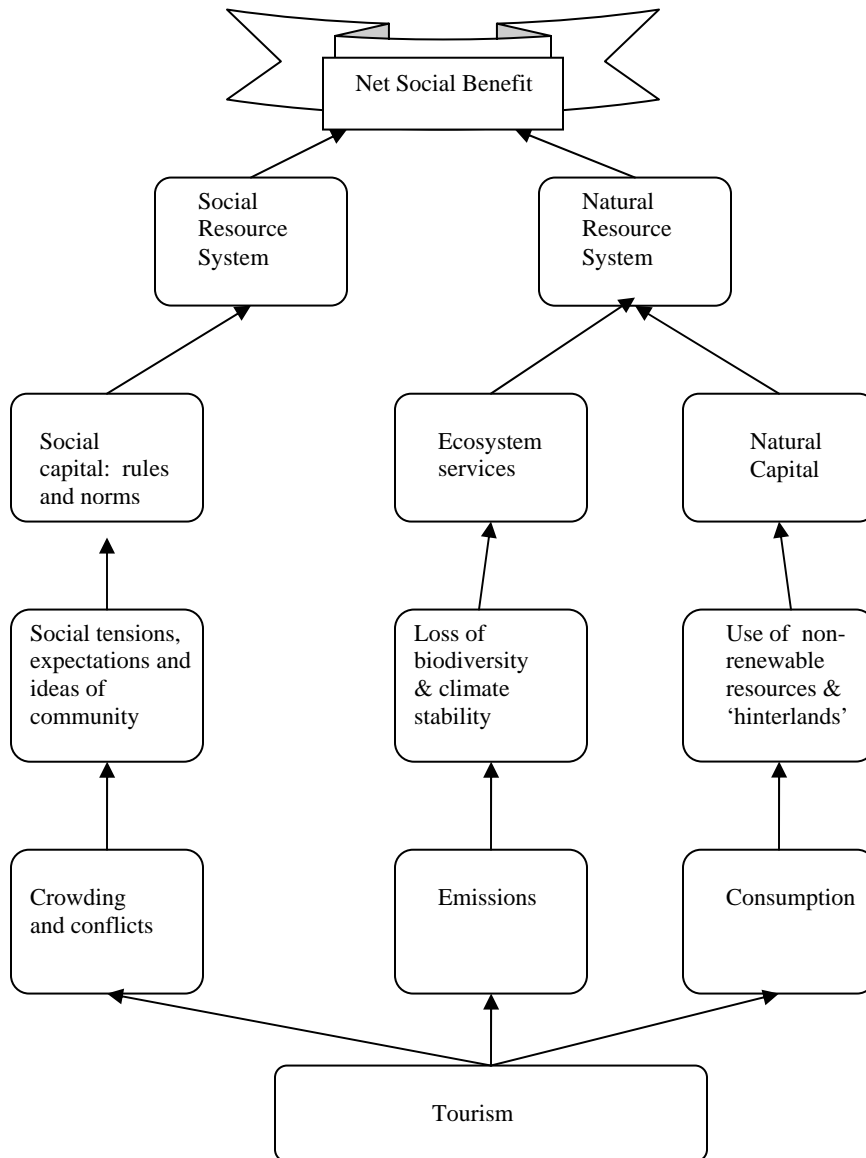


Figure 3.1. A flow chart of principal tourist impacts in Val di Merse on net social benefit of the destination, as explored from the perspective of ecological economics

Natural Resource Systems

Through the daily functioning of ecological and social systems, many natural and social benefits are provided to individuals at direct cost of little to none. *Natural capital* is a relatively recent term, which refers to a “stock of natural assets that yields a flow of valuable goods and services into the future” (Costanza and Daly 1992).

Ecosystems can be conceptualized as having both structure (configuration of biophysical components) and function (as components of living systems interact in time, they form organized patterns) (Levin 1999). Because the stock of resources is often considered separately from the flow of services the ecosystem produces, they are separate in the diagram above. *Ecosystem services* can be defined as ecosystem functions which provide human benefit (Daily 1997). A list of these services, as outlined in Costanza et al., (1997) are Gas Regulation, Climate Regulation, Disturbance Regulation, Water Regulation, Water Supply, Waste Absorption Capacity, Erosion Control and Sediment Retention, Soil Formation, Nutrient Cycling, Pollination, Biological Control, Refugia or Habitat, Genetic Resources, Recreation, and Cultural Material Provision.

When resources are so abundant, it is difficult to imagine that these public assets will not always be free, abundant, and accessible when needed (Daly and Farley 2003; Norgaard 1990). Public goods always seem to become scarce sooner than we think; research has demonstrated that many ecosystem services are declining in quality and availability (Costanza et al. 1997). Thus, a fundamental question for an ecological economics approach to tourism development is how the tourism economy is affecting stocks of natural capital and the flow of ecosystem services. An additional, but important consideration is whether these resources will be adequate to support tourism into the future, or if ecosystem services are being impacted at broader scales than what can be observed at just the local level. We will return to this issue in chapters 7 and 8.

Social Resource Systems

Human wellbeing is derived from a range of market and non-market goods and services, produced and protected by individual and collective actors (Ekins and Max Neef 1992). Maintaining non-market assets implies reliance on social cooperation (Ostrom 1990; Ostrom 1997). *Social capital* is a term even more recent than natural capital, and is defined as the norms and networks that facilitate collective action (Woolcock 1998; Bourdieu 1985; Dasgupta 2002). These interactions among individuals and groups lower transaction costs through cooperation, and knit the social fabric of the destination (Ostrom 1990).

Social capital is central to the daily life of both tourists and residents in their communities. Social carrying capacity is used as a generic term to include both the levels of tolerance of the host population as well as the quality of the experience of visitors of the area (Graef and Vaske 1984). An important non-market factor which influences the “social carrying capacity” of tourism in a host destination is the interplay of and exchanges of trust and norms among the different cultures present. Norms are established and maintained through traditions, exchange, gift giving, and result in a form of social trust which is difficult to measure (Dambacher, Li et al. 2002), but which is also critical to smooth interactions among and between hosts and guests, especially in crowded situations.

One problem with surpassing the “social carrying capacity” is that like natural capital, once lost, few agree on any method to rebuild it. Social mechanisms, institutions, identities and beliefs have been established and maintained over long histories, and is linked to local environmental quality and a strong sense of community (Berkes et al. 1995). Social science researchers cite evidence that social capital is struggling in many parts of the United States (Fukuyama 1995; Verba et al. 1995; Coleman 1990), and that these difficulties affect the institutions that should otherwise govern the equitable distribution of public goods (Ostrom 1990). If social institutions and exchanges do not function properly, outcomes will not be efficient (Ostrom 1996). An ecological economics perspective on sustainable tourism treats social capital as an important non-market contributor to net social well-being. This demands increased attention for the interactions between the structure and function of social institutions, both formal (e.g., laws, governmental units, enforcement) and informal (e.g., cultural rules and norms, civic networks). This issue will be revisited again in Chapter 8, where the case is made for more concrete dialog which addresses institutions at various scales, from the individual to national and global levels.

Section 3: Just Distribution

The Political Ecology of Sustainable Scale

Social and environmental impacts at tourism destinations are embedded in political and economic structures (Patterson and Rodriguez 2004). An ecological economics approach to tourism development requires adequate treatment of the *just distribution* of the costs and benefits it brings. The theoretical approach of *political ecology* lends

conceptual rigor, as it addresses the identification and representation of environmental problems and crises as an intrinsically political process (Blakie and Brookfield 1987; Bryant 1998; Rigg and Stott 1998). Political ecology has sought to expand scientific inquiry by analyzing the frequency and disparity of asymmetrical costs and benefits which often follow from development (Bryant 1992). The aim of these researchers is to improve the lot of marginalized or socially disadvantaged groups by highlighting conflicts, disparities, and the political and human-environmental interactions that drive them, while challenging the path dependent nature within each. Such consequences have been documented at various scales (Bryant 1992), from local considerations such as threatened livelihoods (Bryant and Bailey 1997), indigenous knowledge bases (Bryant 1998), gender and household resource control (Rocheleau et al. 1996; Schroeder 1993), to broader economies, ecologies, and policies between national (Peluso 1992), and (to a lesser extent) internationally relevant institutions (review in Bryant 1998).

More recent studies have applied political ecology analysis to tourism, exploring the distribution of costs and benefits among and within destinations (Stonich 1998; Patterson and Rodriguez 2004; Gössling et al, 2003) and explaining those as a result of linked human-environmental interaction from global to local scales (Blakie and Brookfield 1987). This research has centered on the relative power of various social actors (i.e., stakeholders) with access to, and management of, the natural resources supporting tourism, as well as the relations between actors within, and across the different scales (Pet and Watts 1993; Stonich 1993). At a local level, this has

concerned land-tenure, smallholder investment in new tourism enterprises, and gender divisions within the labor pool, but similar studies have not been made with regards to the political ecology of tourism at a global level. An ecological economic understanding of tourism development necessitates attention for not just the quantifiable impacts themselves, but also for a conscientious look at how these impacts are distributed.

Intra- and Inter- generational Equity

Sustainability and Realms of Concern

Complex, global phenomena such as tourism and climate change often entail problems for governance because of the absence of a real global community in conceptual, emotional, and practical terms (Altvater 1999; Desai and Redfern 1995; Meadows 2001). Some maintain that real community exists only at the national and sub national level and there is no global community (Daly and Cobb 1989). Yet other examples, shows that at some level tourism is playing a role in widening social “realms of concern”. This influence can be seen in both host and guest communities- for example, international charity following the Asian tsunami December 2004 would not have been so great or rapid had there not been tourist presence and familiarity with the host community. Host communities also extend their “realm of concern” toward the origins of their guests, for example, I met a tourist artisan in Brazil who was lead to paint a compassionate picture of New York residents following 9/11, despite having never been there. The theoretical basis for tourism widening our “realms of concern” is that one’s identity is a function of her relationship with her

neighbors, community members, and home environment; encounters with what anthropologists label as “the other” redefine what tourists identify with (Urry 1990). While the agent of rational economic behavior, *Homo economicus*, is considered an autonomous, isolated individual, operating solely in self-interest (Daly and Cobb 1989), tourism experiences widen one’s definition of self-interest. Thus, as tourism becomes an increasingly pervasive global phenomena, one hope is that tourism will positively influence the realms by which individuals feel or express mutual responsibility with others. Because these “realms of concern” are a key factor in effective governance for global environmental problems, I will return to this idea more explicitly in chapter 8.

Tourism consumption and hinterlands

Few concepts as the *ecological footprint* have so effectively drawn attention to consumption issues, and the link to throughput and stocks of natural capital (Wackernagel 1994). On average, the wealthiest members of global population already consume three times their fair share of sustainable global output (Wackernagel et al 1999). Since additional material growth (i.e., throughput) in rich countries would appropriate even more of the earth’s carrying capacity, further reducing the ecological and natural capital available to poor countries, some have called attention to this as ecologically dangerous and morally questionable (Daly and Farley 2003). These authors have argued that when additional “room” for material growth is created (chiefly through technological advance), it should be allocated to the Third World (ibid). In the interest of current and future generations, many have drawn attention to the need for economic growth to be much less material and energy

intensive than it is today (Czech 2000; Cleveland and Ruth 1999; Daly 1989). The ecological footprint also introduced the concept of *hinterlands*, or the energy, materials, and waste assimilation outside the territory of concern which serve to support consumption and waste production within it. Tourism and international trade brings spatial separation between the costs and benefits of resource acquisition and use. One reason why economies grow beyond sustainable scale is because the experiences of one location cannot inform the decisions of another – a reduced ability to control throughput in one place can lead to inferior control over local environments elsewhere (Princen 1997; Akerlof 1997; Daly 1993). Tourism is a consumptive industry, one in which only a small fraction of the world's inhabitants take part. The distributive justice issues of tourism development are therefore an important facet of an ecological economics approach to sustainable tourism.

Industry consolidation and corporate responsibility

Links between tourism and the supporting environments and societies are not necessarily transparent, chronologically determinate, nor tourism-specific, making it difficult to assign sector responsibility for a given impact (Hughes 2002). Problems for decision-makers compound when it is not clear who should take responsibility for once impacts arise, and when consensus is lacking on when actions are warranted, even after negative impacts are observed. Public and private goods are different in this regard, leading some to advocate a private entity such as tourism enclave developments, to have broader jurisdiction over some issues others (eg. Freitag 1994) believe should remain in the public domain.

One of the most detailed and comprehensive reports on monitoring and managing sustainable tourism was issued by the International Working Group in Sustainable Tourism (IWGIST) of the World Tourism Organization (IWGIST 1993; Hughes 2002). The report was favorable to privatization of the public goods which support tourism. For lack of international agreements or institutions which support supra-national use of indices for sustainability, corporations were proposed as the responsible party for trans-national monitoring. Based on scale, the IWGIST recommends that three levels of sustainability indicators be developed to meet the diverse needs of sustainable tourism management: *site* or *destination-specific* indicators, *national-level* indicators, and *corporate* indices. In effect, although the importance of voluntary initiatives and industry participation in sustainable tourism is clear (Dubois 2001), enforcement is frequently left to local and national authorities. Some question whether private, profit-oriented entities have the appropriate incentives to consistently act in the public interest (Barber 1997; Broad 2002). An ecological economics approach to sustainable tourism underscores the importance of cultivating effective global institutions rather than using multi-national private institutions as a default (Daly and Cobb 1989).

Tourism wastes as a public goods problem

Waste emissions which exceed local absorption capacity cause damage to ecosystem services. This has been cited as the most binding constraint on the scale of an economy (Meadows et al 1974; Daly and Farley 2003). However, quantity and form of tourism wastes are generally unknown. This implies a missing feedback which would indicate that limits had been reached. Wastes (e.g., emissions) are a long-

standing problem for conventional economic instruments (Dales 1968). Such activities are considered classic *public goods* problems, where benefits can be freely exploited by individuals, while associated costs are passed onto the public domain. Solutions to public goods problems only emerge once responsibility is assigned (ibid). Ecological economics holds a unique perspective in this regard because it assigns responsibility to the polluter to demonstrate its emissions are not harmful, rather than waiting for a public entity to produce evidence that waste emissions have reached levels unsafe to the general public. To assign such responsibility effectively, an ecological economics position would be to advocate a facilitated discussion among all who have a stake in tourism development to reach consensus on also how to distribute costs. Since individual travelers benefit, should they be held responsible for the full impact of their actions on local and global sustainability? Because host destinations also benefit from tourist visitations, how should responsibility for impacts be divided between host and visitor? Should host destination be assigned all of the responsibility, based on the assumption that social cost will be factored into prices? We don't have answers to these questions, but quantifying impacts from travel is a first step which may bring us closer to real solutions. One solution is to raise levies on travel, discussed below.

The transport subsidy

One argument in favor of expanded tourism is that the cultural, social, or ecological distance of a destination from source markets constitutes a comparative advantage, and that specializing in these "destination products" and trading freely to obtain others, benefits everyone. Despite the potential gains from trade based on

comparative advantage, net transportation costs may ultimately cancel out benefits (Fuchs and Lorek 2002; Daly 1993). An ecological economics perspective views cheap transportation as an effective subsidy for trade. Prices are kept artificially low because the environmental cost of burning fossil fuels is not factored into price. This is especially the case for jet fuel, which is taxed at \$0.00-\$0.02 per gallon, versus \$0.18 for gasoline. The proponents of comparative advantage could not (and maybe cannot) foresee a time when the movement of buyers (i.e., tourists) would constitute a large (and unaccounted) social cost. An ecological economics perspective on sustainable tourism means fully accounting for all costs. Internalizing the environmental cost of tourism transport into travel price would be one way to approach this.

Section 4: Why Ecological Economics Matters to Sustainable Scale

This chapter has illustrated how ecological economics presents a departure from standard considerations of tourism as a contributor to net social benefit- in terms of sustainable scale, efficient allocation and just distribution. First, ecological economics holds special attention for economic throughput. In this dissertation, the indicator of the ecological footprint was chosen because of its ability to draw attention to the consumption which drives economic throughput. Second, an ecological economics approach to efficient allocation means to consider both market and non-market contributions to net social benefit. Emphasis on natural capital, ecosystem services, and social capital are three components which contribute to net social benefit, which are not fully accounted for when using a market-based approach alone. Third, just

distribution is especially relevant to an ecological economics perspective on sustainable tourism because distribution of costs and benefits among and within generations is not always just. Sometimes market-based mechanisms of tourism development are at odds with social institutions that sustain non-market, collective values. Value can be appropriated from socially disenfranchised or marginal actors by more powerful actors, following historical patterns of wealth, power, as well as emerging global interests. The political ecology of tourism development is particularly challenging because many of the impacts incurred at a host destination are those which affect public goods, which in turn affects the ability of a community to provide goods and services (to tourists or residents) sustainably. The next chapter proceeds with a site description and qualitative study of the Val di Merse.

Chapter 4: Quantitative and Qualitative Site Description

*A truly stable system expects the unexpected,
prepares to be disrupted, awaits to be transformed.*
-Tom Robbins, Even Cowgirls Get the Blues

Previous chapters dealt with the inadequacies of current tools and concepts to deal effectively with setting a sustainable scale for the tourism economy in relation to the global natural and social resource systems which support it. As discussed in Chapter 2, the ecological footprint has limitations. It alone cannot be used as a gauge for sustainability, as it does not account for numerous other factors such as social and economic sustainability; it has no firm measure for biodiversity, and is a static index. A complete description of sustainability must also consider qualitative description and trends. This chapter first covers the site description of Val di Merse, and continues with qualitative ecological, demographic, and historical background.

Section 1: Quantitative site description

Located West in the Province of Siena, Tuscany Region of Italy, four municipalities (Sovicille, Chiusdino, Monticiano, and Murlo) form the forested and agrarian watershed (508 km², pop 13,624) known as Val di Merse (Fig. 1). In anticipation of certification as a UNESCO Cultural Heritage site, the Province of Siena, Italy (3,821 km², population 250,000) commissioned a report (Tiezzi et al. 2004) as an Agenda 21 benchmark and to inform policy regarding congestion in the

province's historical center (tourism arrivals to the province have grown over 150% in the past 10 years), a lack of rural employment opportunities, and inefficient resource use. Val di Merse, with only 3.5% of provincial visitors yet 13% of land area has a high number of natural and cultural heritage sites. The area characteristics are viewed as important to sustainable provincial development because agrotourism is believed to have potential to support both cultural traditions and a diversified economy with relatively low environmental pressure. It has thus been identified as an area to disperse tourism from the center- over space and time; yet provincial officials have lacked a quantified means to affirm that development goals with respect to environmental pressure are really being met.

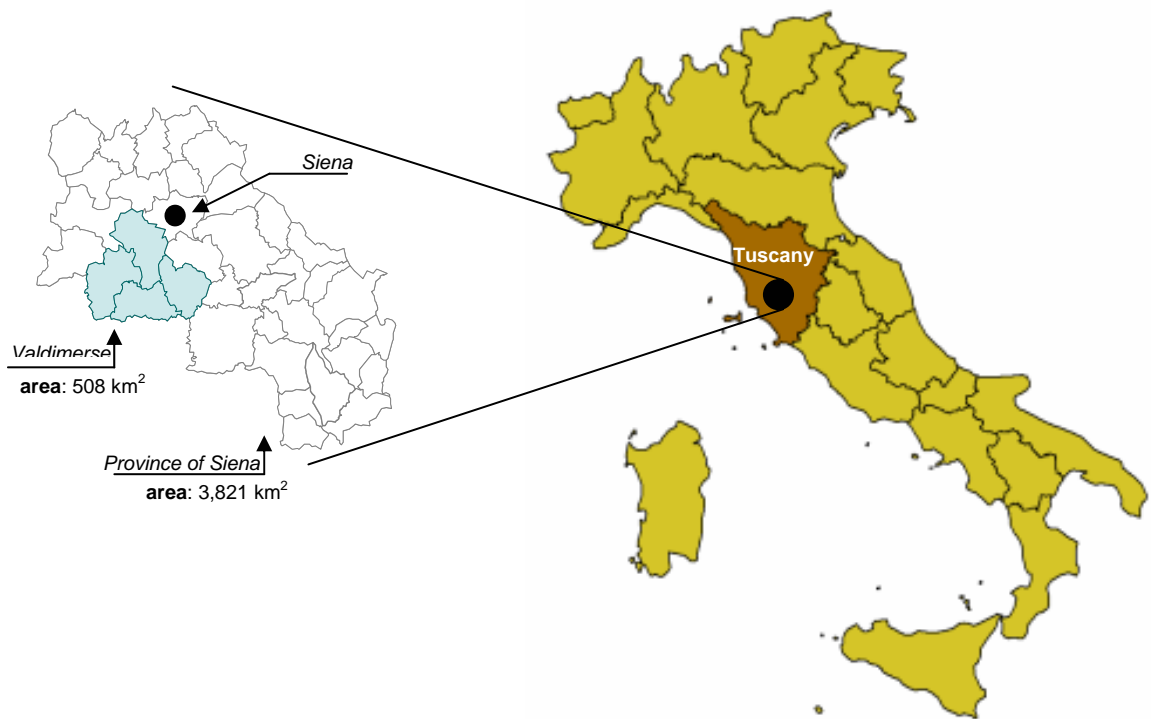


Fig 4.1. A map of Val di Merse.

EF of residents and biocapacity

Val di Merse is a 508 km² valley containing four communes⁹ (Sovicille, Chiusdino, Monticiano, and Murlo), with a total permanent population of 13,600. Sovicille has the largest number of permanent residents, while Monticiano has very few tourists (see Table 4.1)

Table 4.1 Resident and tourist populations Source: (CTS, 2004)

Municipality	Resident population	Tourist Presence (in bed nights)	Equivalent Residents	Total equivalent population (tourists + residents)
Chiusdino	1,918	87,856	241	2,159
Monticiano	1,408	8,400	23	1,431
Murlo	1,932	74,840	205	2,137
Sovicille	8,366	79,017	216	8,582
VALDIMERSE	13,624	250,113	685	14,309

Tourism to Val di Merse

Tourism to Val di Merse is motivated primarily by natural experience, relaxation, gastronomy, and local cultural activities (APT 2000). Tourists have a high average length of stay (5.3 days) with respect to other Italian destinations, sourcing their day-visits from a single place of lodging (CTS 2004). Val di Merse is ‘off the beaten path’; in that its location is not listed in the majority of sources tourists use to plan their travels. Thus, the largest proportion of arrivals is Italian (31 percent), followed by visitors from Germany (22 percent), Great Britain (11 percent), the Netherlands

⁹ A commune is an Italian political unit somewhat akin to a county or canton.

(10 percent) and the United States (5 percent). The remaining 21 percent come from European countries (16 percent) with only and 5 percent traveling from other areas of the world (see Fig. 4.2). Due to remote geographical location, business travelers or day tourists are very low in number and unlikely to influence tourism statistics.

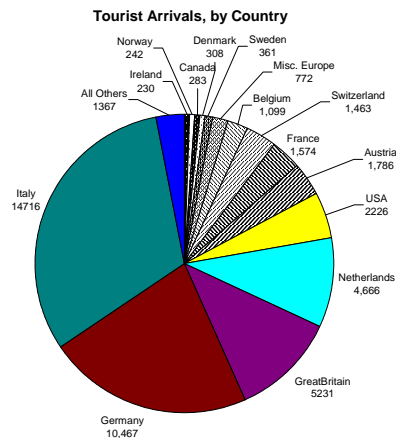


Fig. 4.2. Tourist arrivals to the Val di Merse, by country. Sources: (CTS 2004).

SPIN-Eco and Tourism Development in Val di Merse

In anticipation of certifying as a UNESCO world cultural heritage site, the Province of Siena, Italy (3,800km. sq, pop. 250,000) commissioned a report to describe its 23 municipalities according to 5 indicators of sustainability: carbon dioxide balance, ecological footprint, natural capital, emergy, and exergy calculations. The information was to be used as a European Union Agenda 21 benchmark, and to inform the most pressing development challenges: congestion in the historical center of the province, a lack of employment opportunities in rural areas, and overall inefficient resource use. The tourist industry, having ballooned from 800,000 to 2,020,000 in the past 7 years, was seen to be a key factor in each of these problems-

overwhelming infrastructure, and contributing to growing discontent among residents. As a result, provincial managers suggested two strategies to maintain economic growth: tax tourist visitation to the historical center, or spread tourism development to rural areas of Siena. This dissertation focuses on the second option.

Preliminary results of the above-mentioned report identified four municipalities to have an especially large surplus of renewable natural resources and natural and cultural heritage sites in need of restoration. Provincial leaders thus suggested this area, the Merse watershed, be developed to accept tourism overflow. This development would bring great changes to the Merse, a rural agrarian and forested valley of 580 sq. km, with little industry, and a population of 14,000. Some of the changes would be welcome: over the past 50 years, increasing mechanization of agriculture and the declining profitability of the timber industry have led to sharp declines in local employment opportunities and abandonment of country homesteads. Yet Merse residents distinguish their rural townships and lifestyles from categorizations of being economically *depressed* (Patterson 2002). Most residents are proud of their rural way of life- frequently citing the Tuscan agrarian identity, the tendency for social co-operation, and the wealth of natural resources as the historic sustenance of the population- even through the most bleak war and post-war periods (ibid).

Section 2: Qualitative Site Background

Historical Background

Tuscany's accumulation of capital as we know it began in the medieval period. Val di Merse itself is located at the locus of two ancient roads of commercial, cultural, and religious importance, one to Maremma, and one to Massa Marittima (near the sea) and the Colline Metallifere (metal hills). The presence of these two roads contributed to Siena's importance as a governing center, and was the site of the Sistine Monastery of San Galgano which had profound influence on the welfare and culture throughout the Province.

Val di Merse attracted inhabitants for its wealth of local natural capital (notably from the river Merse), malaria free climate, good soil climate for cropping, and its proximity to Colline Metallifere (metal hills). From this period, the area actually has one of the earliest histories of giving hospitality, as parish churches, hospitals, lodging houses and inns were located along these roads for pilgrims and merchants traveling to centers of religious importance in the Middle East. Through time, the dynamic of natural riches, transport of goods and people, and seats of traditional wealth combined to create a locus of transport which defined corridors of wealth across Tuscany. These in turn fortified religious settlements, which in turn influenced land use, planning and engineering.

Eventually, the area experienced several downturns precipitated by mercenaries, plague, recession, and depopulation. At the mid 14th century began the rise of the Mezzadria, an era of share-cropping which lasted right to the 1950's. Rural Italy's

share-cropping system molded the Tuscan landscape according to a rigorous system of highly diversified agriculture worked by tightly-networked family collectives. Notable characteristics include the wide variety and creativity among the family members in producing artesian products, waste minimization, mixed cultivation and self-sufficient agriculture, the architecture of the period which continually evolved to accommodate family members and farm activity, and finally the spatial relationship of the village settlements (Paba and Paloscia 2002).

With the end of the Second World War, the Mezzadria ended, and most of rural Italy underwent rapid depopulation, as individuals moved to the urban centers and villages. In Val di Merse, this shift in land tenure, combined with increasing mechanization of agriculture, has resulted in an economy which is less active than other commune of Siena. Employment opportunities for younger community members are limited in Val di Merse, leading many to search for work in Siena city center, or to other parts of Italy, or abroad. The historical and natural assets of the area have long determined a relatively high standard of living for Val di Merse's inhabitants.

Demographic and Economic Background

The rapid growth in tourism presents an opportunity to study socio-cultural shifts in a given area (Chambers 2001), These shifts follow changes in land-use, have also implications for sustainability- not through the direct loss of ecosystem functions, but through the indirect impacts of consumption, waste loads, and the cumulative impacts of cultural encounters among dissimilar groups.

Many similarities will be found with Val di Merse as a destination and areas of industrialized countries that are relatively new to the tourism market, principally because of their rural location. These are areas located further from the popular urban centers, or “off the map” with regards to the most typical conceptualizations of tourism to a given country. Emerging European Union countries are likely to find many similarities with this case study.

These areas face common challenges. First, they have likely undergone an extended and possible continuing period of rural depopulation following the rising industrialization of agriculture and associated shifts in land tenure (such as the fall of the mezzadria). Second, these economies have often undergone a shift from extractive to non-extractive industries. Concomitant with rural depopulation driving decline in human capital, pressures of unemployment and economic restructuring can result in added social pressures to these areas. As a result, out-migration, extended commutes to employment location, or the dispersion of families across great distances may be typical, even though they are less desirable alternatives to individuals, and not socially optimal alternatives with regards to economic or sustainability considerations. Third, these areas are often high in levels of natural capital. Val di Merse, for example, is highly forested and provides high levels of non-market forest products to local residents. Rural areas may also be high in cultural capital and heritage assets that have not yet been capitalized upon for tourism purposes. However, while this offers the potential for development of a niche market oriented towards these assets, it also constitutes obligation on the part of maintenance of

cultural and natural patrimony. This leads to our fourth commonality among rural tourism destinations, which is that many have undergone subtle but persistent shifts in land-use change. This means that the changes that come as a result of tourism expansion (i.e. more paved roads, more need for water and waste processing, more traffic, etc) will have an increased effect as a result. Therefore, careful attention to the trends of land-use change and natural capital depletion, and the resultant vulnerabilities they may have introduced into the provision of ecosystem services and biodiversity maintenance, is particularly warranted in these areas. Lastly, a commonality among rural tourism destinations is that they are particularly suited to link agriculture with tourism endeavors. If given proper support, rural tourism areas can be poised both to capitalize on these advantages and provide critical support for traditional knowledge bases through traditional and regionally typical products, organic and artesian production, and a particular emphasis on quality control.

Landscape Description

In order to understand the current reality of ecological economic change in Val di Merse, knowledge of land use and social dynamics of the area are useful. From there, one begins to understand many of the relevant trajectories of development effecting social and ecological processes. A comparison of aerial photos from the years 1954 and 1996 readily demonstrates the effects of this change at the landscape level¹⁰.

Aerial photos:

¹⁰ For 1954, Ortofoto Volo GAI, image refinement courtesy of Etruria Telematica, Siena. For 1996, Ortofoto Volo AIMA courtesy Ministero delle Politiche Agricole, Siena

The series of aerial photos puts into evidence a visual example of many of the above observations between years 1954 (fig. 4.1, 4.3, 4.5, 4.7) and 1996 (fig. 4.2, 4.4, 4.6, 4.8). At the broadest scale, one notes the diversity of field type, and the sparse forest cover, constructing an overall mixed landscape *mosaic* in 1954 (fig 4.1). At the top of the figure, the venations of the primary order streams are visibly apparent. By 1996, many of these first order streams have been filled in, and fields mechanically flattened. Field diversity has diminished, and forest cover increased, creating a more distinctly '*patchy*' landscape (fig 4.2).

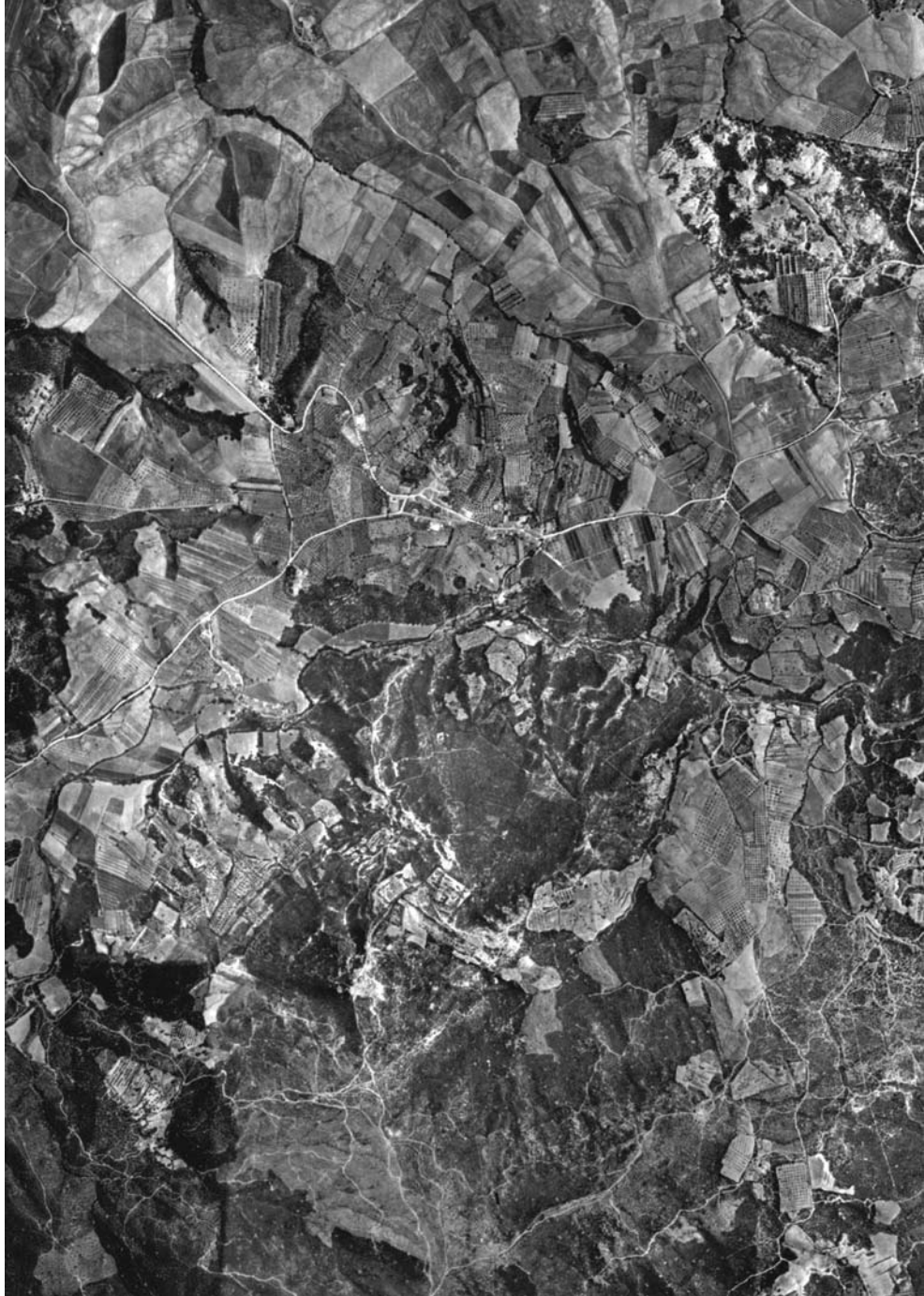


Figure 4.3 1954 Landscape mosaic



Figure 4.4 1996 Landscape mosaic



Figure 4.5 Chiusdino 1954



Figure 4.6 Chisudino 1996

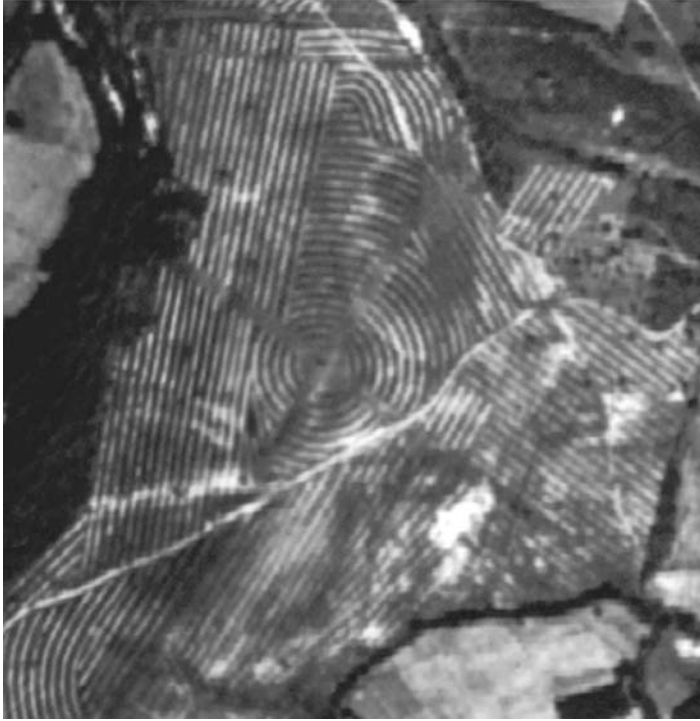


Figure 4.7 Field tenure 1954

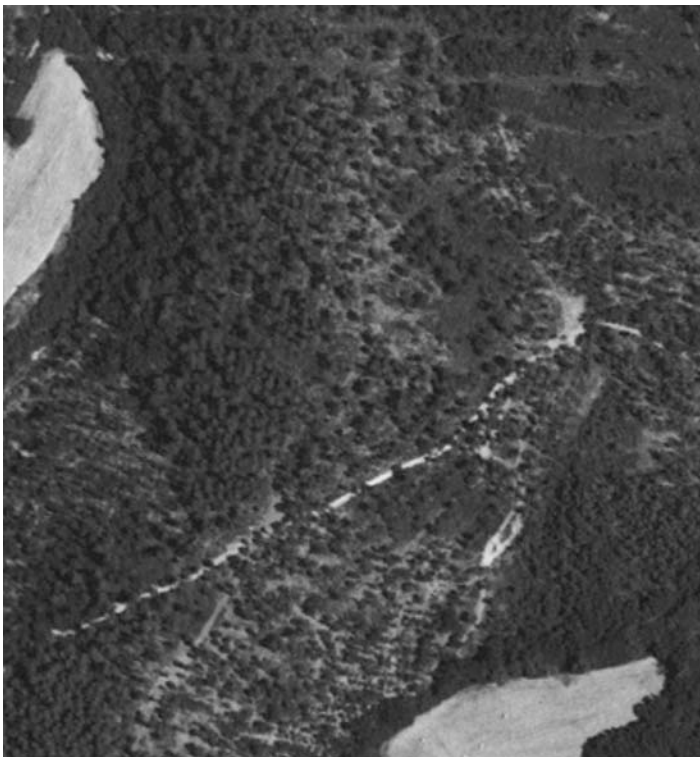


Figure 4.8 Field tenure 1996



4.9 Vegetative buffer 1954



4.10 Vegetative buffer 1996

As demonstrated by figure 4.3, an image of the town of Chiusdino in 1954, the boundaries of historical centers in were well-defined, and surrounded by gardens to feed town residents. An image of Chiusdino in 1996 shows the beginning of a city sprawl, the result of share-coppers moving from homesteads towards the city centers (fig 4.4). While some gardens remain, per capita, the town now imports a great deal more of its food.

Some areas which were maintained for agriculture in 1954 have been abandoned by 1996. This is true of especially terraced or steep areas and areas along second and third order streams. While accessible with careful use of traditional agriculture techniques (fig 4.5), these areas are probably unable to support heavy or large mechanical equipment, and thus have been abandoned (fig 4.6).

Vegetative buffer areas along many parts of the Merse River (running top to bottom, left side of image 4.7 and 4.8) have increased. Meanwhile, much of the vegetation separating fields, and lining roads and pathways, and vegetation in the middle of fields have been reduced between 1954 and 1996. Precipitation in the area has declined over the past 50 years, and while flow level data for the Merse River has not been located, a reduced width and meander of the river banks confirms the likelihood of greatly reduced flow and flux among river stages.

In summary, the following observations changes between 1954 and 1996 are noted from the aerial photos. Regarding changes between land-use categories, the confines

of forest cover in the Val di Merse region have remained fairly consistent. The actual forest cover within these areas has greatly increased. The confines of agricultural areas have changed: fields have been abandoned, especially in hilly areas and first order streams evident in 1954 photos have been filled, and cultivated. Second and third order stream areas have not been filled in, and some have increased in vegetation cover. Agricultural fields have become much larger and more homogenous. The confines of urban areas demonstrate a sprawl from the city centers of Monticiano and Chiusdino. The smaller town centers have not similarly grown in area. Areas of mixed-use gardens, especially close to urban areas, are greatly reduced.

Regarding changes at the boundaries between land-use categories: vegetation at the confines of fields has been greatly reduced. Vegetation corridors along streets, trails, and streams have been removed while vegetation along the banks of the Merse has been removed in some areas, but has increased in other areas.

Changes within land use categories have been observed: vegetation within fields has been reduced (trees and shrubs). Agricultural areas previously of mixed-use category are more frequently single-use. Fields which were previously convoluted have been flattened, also affecting first order streams and water flow within the field.

The above are initial qualitative observations; quantified analysis is needed to produce conclusive results. Decreasing crop diversity, increasing field size and mechanization, decreasing texture of land, increasing specialization and permanent

crop allocation, decreasing frequency of crop rotation, increased use of herbicides, increased use of pesticides, less robust grain seeds, more frequent drying of fruit branches, less diverse/ less flavorful fruit trees, are all observations which may accompany the observations from the aerial photos above.

Ecosystem Dynamics

Each patch of land cannot be considered isolated from surrounding patches, neither can they be considered distinct from the moment they are placed into the complex network of ecosystems which make up the landscape mosaic. This section discusses some of the human-mediated dynamics of the area's forests, watersheds, and wildlife populations. The overall trend depicted is that of widely distributed, but profound ecological impacts which sometimes present difficulties to researchers in perception and quantification. Understanding these past impacts of human-land use change is critical to hypothesizing projections of how the area will react to a further economic shift, such as the one presented by increasing tourism visitation and recreational use of the area.

Forest Dynamics

Forest cover has increased in nearly all areas of Val di Merse. At the same time, over the past 50 years, use of the forests for charcoal, firewood, chestnut production, and animal grazing has become almost non-existent. There is also a marked decrease in the general number of trails through the forest areas, although in some areas there are visible impacts from areas experiencing high-use by off-road vehicles.

General trends in forest structure are not possible to discern from photos taken from above, although it is likely that diversity in forest structure has declined, as a result of the closing of the forest canopy and a reduced amount of human and animal traffic in the forest undergrowth.

From the 1960's to the 1970's, Maritime Pine was a popular species for reforestation in the Merse Valley. While this species is no longer used in reforestation, visual assessments suggest that pine stands may be increasing in area. This has implications for forest biodiversity, and forest maintenance considerations. In the forests of the Merse Valley, the highest biodiversity is found in areas with higher humidity, and with higher pH (Chiarucci 2001) Presence of pine tends to close the canopy, and lower the soil pH, thereby closing out other species. In the event of fire, Maritime pine burns rapidly. The pine thrives in drier conditions and colonizes rapidly in disturbed, eroded, or burnt areas. As climatological data suggest that areas of Tuscany are in a period of declining precipitation and humidity, it would be prudent to study the growth of pine stands over time, and correlate them with a suspected reduction of biodiversity. Some work has been done to apply models of climatic change (namely, BGC) to Tuscany forests, and this information could be particularized for the Merse region (Chiesi 2002).

Watershed Dynamics

The Merse has been increasingly used as a source of irrigation water, while the streams and river itself are increasingly being used to absorb pollutants of industrial and agricultural origin. With regard to watershed structure, should the trend observed

in the aerial photos be conclusive, the Val di Merse area is experiencing a loss in first-order streams. With reference to ecosystem services, these can be critical areas for incubation of stream animals, and act to filter sediments out of the stream areas. While mechanization has allowed the flattening of the field areas, and the claiming of areas which were previously too wet to be productive agricultural areas, the net effect will likely to have been to reduce the water retention capacity of the soil, and to speed water, sediments, and agricultural pollutants into remaining second and third order streams. Within the Merse watershed, macro-pollutants¹¹ of agricultural origin have been seen to significantly reduce biodiversity and influence the community structure of the streams and Merse river (Barbaro, pers.comm. 2002), and increase the presence of toxins among remaining fauna (Casini 2002).

The decline in biodiversity and water quality of the area can be considered to have affected human use of the area's water resources. Largely as a result of increasing awareness of the Merse river arsenic contamination, most local residents do not consider the Merse suitable for bathing. However, the presence of the mine has been long impacting the watershed itself, and resulting pollutants have likely concentrated in fish species. Fish, freshwater shrimp, and frogs were frequently part of the local diet 50 years ago. To date the area has experienced a decline in many amphibian species, a disappearance of freshwater shrimp, and freshwater fish have declined in abundance and quality (Barbaro, pers. comm. 2002).

¹¹ Micro pollutants are defined as mineral or organic active product likely to have a toxic action with negligible concentrations (order of the µg/l or less), and are differentiated from macro pollutants which are natural molecules, that are in different concentrations from those usually observed in the environment.

Wildlife Population Dynamics

A conclusive study of changes to specific animal populations in Val di Merse is far beyond the scope of this study. However, as viewed from the perspective of landscape ecology, we can surmise several trends affecting the landscape. During the transition stages of forest growth, thick underbrush may prevent free movement of many large game species (with the exception of wild boar). However, once a diverse forest structure is established, it is likely that the forested areas will provide cover and support a greater number of large game species than in the 1950's. One possible exception is areas highly populated with pine species, which have been noted to support less animal diversity than deciduous stands (Di Dominicis pers. comm. 2002).

The landscape of Val di Merse in the 1950's, offered a mosaic of habitats, each connected by a network of vegetation. The landscape of the 1990's, in contrast, offers a very different arrangement, with highly homogenized vegetation cover, and isolated patches of habitat. While this development may increase populations of animals dependent on large, dense forest stands, the clearing of vegetation among fields, roads, and riparian areas is likely to impact population dynamics and diversity. Bird species, in particular, have been noted to have been impacted in the area either through a reduction in food availability, or a reduction of suitable habitat, or the increase in pesticides.

Socio-cultural Background

Assisting a community in articulating a shared vision for quality of life can be an important step in safeguarding net social benefit while elucidating what makes a community culturally attractive to visitors (Chambers 2001). Locally based, culturally specific welfare assessments are unusual. Most often, welfare is assumed in terms of statistics; i.e. length of life, health statistics, access to education, literacy, telephones, automobiles etc. What is missing from this approach is an aspect of cultural specificity, which sets the norms of a culture apart from others. Just as the world is losing its biological diversity, globalization presents a threat to the cultural diversity of previously distinct populations. This diversity feeds much of the hunger for the travel experience, and contributes to the attractiveness of a destination.

The following are aspects of socio-cultural considerations of the study area: social dynamics (migration, work availability, family structure, labor demographics), traditions (celebrations, cultural identity and activity), eco-cultural resources (traditional uses of natural products, medicines, foods, etc), environmental quality (pollution, noise, waste control).

Residents of Tuscany's countryside often remark that the quality of life has risen between the time when the Mezzadria fell and the present. This is attributed to length of life, the comfort of present day houses, and the freedom of mobility. However, many note that because of its agricultural sufficiency, inhabitants of Val di Merse were always generally well-off with respect to other areas of Italy, especially during

the post-war era. Economically, many residents view themselves as better off than 50 years ago, but note that the length of the work-week is the same or greater than in the past. Family structures are much smaller now (3 or 4) as compared to the past (12 average), and family members are noted to be less well connected than in the past. A decline in cooperation among neighbors to perform maintenance or labor tasks can be expected because of the depopulation of the *casa campagna* (country households). Declines in quality of life related to work in present day may be attributed to loss of their smaller town centers, as younger members of the community leave the area to search for work in Siena or in other more urbanized areas of Italy.

Rural lifestyles are changing, and this may be accompanied by loss of several traditions from the *mezzadria* to present day, especially those related to the harvest cycle, such as the *Trebiatura*. Religious holidays may be celebrated less frequently, or with less ceremony. Declining use of plants as traditional medicines or veterinary products, as well as a declining or outright disappearance of many food sources, as well as some animal species is likely.

Local perceptions of the pollution of the Merse river, an area with historically high Arsenic levels from mine tailings, is frequently the first observation a Merse resident makes about quality of the environment. Noise and waste were are not generally viewed as negatively impacting quality of life, however, some residents express annoyance with off-road vehicle traffic and the fact that local trails are not otherwise maintained for hiking. Tourism flows, especially during mushroom season are well

tolerated, especially since mushroom availability cannot be predicted so foreign tourism is low. Hunting traffic is usually restricted to weekends, again considered to be a tolerable traffic. Traffic congestion is often cited to be a problem by those who commute between areas of Val di Merse and Siena.

The nostalgia of a way of life since passed is not to be confused with a true decline in quality of life. However, it should be noted that the loss of traditional knowledge bases can be signs of decline in broader environmental quality, and in qualitative terms, a decline in biological diversity among the species that once were important to inhabitants of the area.

Economic System Dynamics

Tourism expansion is often a favored development strategy as it makes a rapid and favorable impression on those economic indicators most frequently regarded as economic success (e.g. GDP). However, as economic indicators frequently follow measures of economic *activity* rather than direct contributions to human well-being; it is prudent to pay attention to exactly how much of the economic activity resulting from tourism actually produces local benefit.

Economic Leakages

The increasing level of foreign ownership of tourism capital in many areas of Tuscany, for example, has been a point of concern in this regard. While initial capital injections may increase local tax revenues, the long-term effect of foreign ownership may result in lower net benefits for the local community. Foreign-owned businesses

ex-patriot profits, and may be less inclined to hire local workers, buy local produce, or prepare local dishes, in comparison to locally owned businesses. Pentolina, a Sistine Monastery in Val di Merse, was purchased and renovated by a Swiss-owned multinational. Renamed, “HappyMac”, the all-inclusive resort contributes little to the Merse economy. While the resort contributed favorably to the local economy during construction phase and initial hiring, the local employees have been gradually replaced with Swiss workers.

Sometimes the effect of foreign ownership can be best described with use of a *tourism multiplier*: an economic algorithm which calculates the extent to which tourist euros are re-spent in the local economy, thereby stimulating further economic activity (Lundberg, Krishnamoorthy et al. 1995; Lundberg 1995). The euros which leave the economy are termed as *economic leakages*. Leakages from the local economy may result from the importation of goods from other areas, from the employment of foreign workers, from investment of local profits elsewhere, or from foreign ownership of infrastructure sending large profit margins abroad. Tourist economies can minimize leakages to the local economy by buying local goods—especially produce, hiring within the local area, and by establishing limitations on foreign ownership of infrastructure and development.

Agriculture and Tourism Links

The local diversity and self-sufficiency of agricultural supply has declined in Val di Merse, while imports of food products have risen. Should this trend continue as the level of tourism visitation in Val di Merse rises, increasing tourism will lead to

increasing imports, and the local community will miss out on a potential opportunity to diversify its economy and increase the local capacity for self-sufficient agriculture.

Micro-enterprise and cooperative networks

Val di Merse lacks capacity in cooperative networking among local producers.

Opportunities for small and medium sized locally owned businesses are limited and are not well connected to the tourism market. Cooperative efforts of marketing and promotion could empower networks of small local businesses with high standards for sustainability to reach local and international tourism markets. A challenge common to small communities initiating tourism development is often the extent to which potential producers are prepared to receive tourists. Raising standards, especially with regard to sustainability, without imposing a disproportionate amount of regulation or legislation on producers is an especially difficult issue for the community.

Economic Diversity

While much of this section focuses on increasing the tourism economy in Val di Merse, tourism dependence is the other side of the development coin. Encouraging a locally integrated economy, self-sufficient agriculture, and diversity of production, will buffer the area from external economic shocks as well as reduce economic and environmental costs of transporting goods.

Section 3: Summary

A common theme in this chapter can be identified as the loss of buffers. Landscape cover, species and crop diversity, oral histories and traditions, are all examples of natural buffers. They are important to the delivery of ecosystem services and

therefore sustainable human use of an area because they soften the impact when it is undergoing change. Demographic shifts, economic shifts, climatic shifts, population shifts (in terms of tourists) can all be considered relevant changes to the system which may affect the territory's ability to sustainably produce natural capital.

Loss of biodiversity is an important issue to rural areas considering tourism expansion, mainly because these areas have undergone mechanization in agriculture, urban or industrial change within the past 50 years- increasing the likelihood they have lost some buffer capacity. This chapter mentioned species in running water and riparian areas as being particularly sensitive to these types of land-use changes, while amphibians are particularly sensitive to pesticides and herbicides.

Mechanization and urbanization of day-to-day life distances the general population of rural host communities from the knowledge of the natural world which was once required for survival. Local knowledge is usually based on intimate and prolonged interaction with a given set of biophysical conditions, and as a result, local people in possession of that knowledge are often best placed to understand and regulate those conditions. Tourism can have the effect of increasing visitor and host tendency to view the natural world and its beauty as a commodity (Urry 1990). In Urry's view, this is problematic and advocates the role of local eco-cultural knowledge in sustainable tourism, because it serves to buffer eco-cultural traditions from the cultural change that tourism brings.

In the Val di Merse, the past 50 years has witnessed a particularly sharp shift in rural demography. Many residents have moved from an agrarian economy to what is industrial, specialized, or tourism based. Tradition and oral history are one way a culture buffers itself against another. Cultural aspects of sustainability are particularly relevant to an ecological economics approach to sustainable tourism because tourism can bring new trends of consumption to the host community, and consumption is what drives economic throughput. Typical tourism trends are towards pursuing a “second home”, cheap trips, spontaneous decisions, more mobile travel behavior, more frequent, shorter trips, greater distance, ‘exotic locations’, rising expectations of amenities and service, rising habits of consumption. While rural tourism presents an opportunity in that agro-tourism allows locally produced organic foods such as wines and olive oil, and supports rural agriculture initiatives and small businesses with low leakages, the darker side is that increasing rural tourism runs the risk of auto-tourism, where most of the rural landscape is experienced through the windshield of a rental-car. Auto-tourism promotes increasing petroleum dependence, increasing consumption of imported goods, allows the transfer of an urban (rapid) lifestyle to a cultural area of slower pace. An ecological economic perspective on sustainable tourism advocates local, culturally relevant tourism development strategies which link tourism to the social, cultural and eco-cultural resources that support it.

Rural tourism in Siena presents an interesting case study opportunity, because there are two populations which can be sampled in the area: the tourists who have driven

economic transition based on consumption, importation, and petroleum use increases, and those of the original rural population: whose traditions of frugality, recycling, gleaning (the act of following behind a first harvest to salvage remains), knowledge and diversity of plants, animals, and their uses is slowly being eroded. Therefore, with the issues above in mind: biodiversity loss, declining eco-cultural knowledge, and cultural homogenization, we turn to the task of finding an appropriate balance between the trends of the ‘two cultures’ (one rural and in need of some combination of economic opportunity, one cosmopolitan in need of a destination and the capital to support consumption).

The subject of the next chapter is the ecological footprint as a quantified comparison between these two groups. As mentioned in the introduction, a need exists for quantified study of tourist populations, which include the full global extent of their impacts. An ecological footprint is one place to start with that, but it is not sufficient to understand sustainability. This chapter has described some of the systematic landscape and social trends which may cause the destination to be more vulnerable in the face of disturbance (i.e. climate change) than it appears.

Chapter 5: The EF of Tourism in Val di Merse

Travel has a way of stretching the mind. The stretch comes not from travel's immediate rewards, the inevitable myriad new sights, smells and sounds, but with experiencing firsthand how others do differently what we believed to be the right and only way.
Ralph Crawshaw

Paesi che vai, usanza che trovi.
Livorno (IT) dialect:
(Wherever you go, use what you find)

Until this point, I have focused on conceptual inadequacies of conventional theories of sustainable tourism (Chapters 2 and 3) and some qualitative observation suggesting social and ecological changes which have occurred in the past 50 years and which may influence the case study site in its ability to absorb increased tourism levels (Chapter 4). This is the background for detailed quantified analysis of tourism's cumulative load on the biosphere, in terms of local (Chapter 5) and global (Chapter 6) impact.

Section 1: Intro to the Ecological Footprint and Tourism

Few indicators as the ecological footprint have drawn as much attention to humanity's over consumption of Earth's biocapacity- by some estimates over 20 percent, and the disparities between how rich and poor nations contribute to and experience this deficit (Wackernagel 1999, 2000, 2002; Troell 2002; WWF 2002, 2004; Monfreda 2004). This chapter applies the ecological footprint to two populations- tourists and residents in a rural area in Tuscany, Italy.

The application of the ecological footprint to tourism is not new, tourism certification strategies (Synergy and WWF; 2000; Best Foot Forward 2002), and researchers (Gössling et al. 2002b, 2005; Bagliani et al. 2004), have applied this method of analysis to several destinations, drawing attention to the “ecological hinterland” necessary to maintain the tourist presence at the destinations. To this point, the examples explored have covered namely mass tourism, which arrives by airplane to destinations for which complete data is available (eg islands). Here I use the ecological footprint to quantify the environmental pressure due to tourists as “ghost” inhabitants, a population which otherwise is not usually considered in impact assessments or municipal planning, and compare it to that of local residents.

The study site is of high environmental quality characterized by “alternative tourism” (eg, nature, eco, agrotourism¹², distinct from mass tourism), an area in which the majority of tourists come from highly consumptive nations, and an area which arrivals by air, rail, bus, or auto are possible. Its small area and relatively small tourist population, made interviews feasible to establish tourist consumption, in contrast to other studies which have used broader civil statistics to produce ecological footprint estimates.

Performing this estimate has the additional benefit of improving civil administration knowledge about local resident consumption. For example, in areas of high tourist

¹² Agrotourism is defined by its rural agriculture nature, in Italy at least half of the tourism structure’s revenue must come from agricultural sources, the products must be served to tourists along with typical dishes of the region.

presence, civil electricity consumption which is attributed only to a resident population may be overstating resident demand. Distortions in energy use (relative to resident populations) are considerably less for tourism in Val di Merse than they would be for destinations whose tourism forms are more energy-intensive (Becken and Simpson 2002) or which occur in climates requiring a more temperature control (i.e., higher and lower latitudes) (Gössling 2002; EPA 2000).

Section 2: Methods

Tourist Equivalent Residents

The number of equivalent residents (T) represents the total number of all tourism *bed nights* in Val di Merse (arrivals multiplied by length of stay) divided by 365. This value ($T=685$) signifies a “full-time” inhabitants equal to 5% of the registered population which consumes resources, creates waste, and which municipal leaders must consider in planning urban development, but heretofore has not received civil statistical consideration (Table 1).

The Use of the EF

As explained in chapter 2, according to the IUCN classification, EF calculations for tourists and residents were based on six types of ecologically productive areas which provide resources and waste assimilation: fossil energy land; cropland; grazing land; forests; built-up land; and fishing ground. The productivity differences among land uses and between local and global productivity within a given land-use category were

considered via use of equivalence and yield factors respectively (WWF 2002; Wackernagel 2002; Monfreda et al. 2004). The results were weighted ecological surfaces stated in abstract “global hectares/person/year,” rather than hectares (which refer to actual surface area). Average consumption statistics of each of the four municipalities were weighted by municipal population to arrive at the valley’s overall Ecological Footprint (Tiezzi et al. 2004; Bagliani et al. 2003). Tourist consumption categories are detailed at length, below.

Data Collection

Closed ended interviews took place at the Abbadia of San Galgano (Chiusdino), a ‘gateway’ site frequented by most tourists to Val di Merse, and were conducted with 220 tourists, over 10 days June through August of 2003 (Patterson, 2005) (See Appendix 1 for list of questions). Only tourists over the age of 18 were queried, and one member of the group was asked to respond for their group or family. Interviews were conducted by the same interviewer in Italian, Spanish, English and French. Queries established age, country of origin, family size, travel group size, mode of transport, daily travel distance, accommodation site, where meals were typically purchased, and souvenir purchases. Tourists were presented a map and list of activities and asked to identify day-trip destinations and activities participated. Elaborations on energy, water use and waste production were collected from 20 lodging providers within 15 kilometers of the site and informed the municipal data in estimating combined resident and “equivalent resident” (*T*) population use.

Data for land use was derived from CORINE land cover (Provincial Administration of Siena 1996), local resident food consumption (ISTAT 1999), electricity (GRTN 2000; Provincial Administration of Siena 2000), combustibles -propane gas, heating oil, resident automobile fuel (DGERM 1999; Tiezzi et al. 2004), waste (Sienambiente 2002), water (Acquedotto del Fiora 2001), consumer prices (Tiezzi et al. 2004 and this study). While data sources were cited as close as possible to reference year 2003, the use of some resident data as old as 1999 was viewed as an acceptable discrepancy as neither resident consumption levels or population have risen over the past 5 years (CST 2004; Tiezzi 2004).

Tourist “equivalent resident” consumption was divided into the following categories: arrival transport; local transport; accommodation (including land, energy, water, and heating fuel use); food and fiber consumption; waste production; and activities (e.g., entertainment activities, and souvenir products). The resident EF was designated by standard household consumption categories: food and fiber consumption; housing; local transport; civil services; other consumed goods and waste production.

Arrival transport

This category refers to the total roundtrip distance of visitors to Val di Merse, as estimated from arrival data collected by CTS (2004). Depending on the mode of transport, arrivals were associated with four transport modes combined in three different scenarios.

34% of foreign tourists arrived to Italy by air travel. The total distance traveled by each visitor was multiplied by a CO₂ conversion factor as specified by Wackernagel et al. (2002). Any distance pertaining to air travel was multiplied by a factor of 2.7 (ibid), to account for additional radiative forcing resulting from either airline emissions at altitude (IPCC 1999). The shortest circular distance was calculated roundtrip from the capital city of the country of origin to Pisa, the airport most typically used for arrival to Val di Merse. A previous study has used a similar approach (Gössling 2002b). To this value, 300 kilometers of roundtrip automobile travel were added (detailed in local travel subsection) to account for the distance from Pisa to Val di Merse. Conversion coefficients for car travel (Chambers et al 2001) were weighted by 2.5 to reflect the average car load (Patterson 2005). Of the remaining 66% of foreign visitors, 50% arrived to Siena by public or private car or coach, 16% by bus or train travel to Central Siena. Of Italian tourists, 83%, 17%, and <1% arrived by car, bus or train, and air, respectively (APT 2000). Additional ground transport within Val di Merse is considered within the category *local transport*.

Food and fiber consumption

Tourists are constrained to eat typical Tuscan style dishes while in Val di Merse. This information contrasted with the approach adopted by (Gössling et al. 2002b), who associated travelers' food consumption with the food EF of their countries of origin. Estimates for typical diet of the central Italy, based on data of National Statistic Yearbook (ISTAT 1999) were applied to the EF formulation (Bagliani et al. 2003) updated with 2002 conversion factors. While the actual food content may be similar

between tourists and residents, factors for restaurant and bar use were doubled for tourists to reflect more frequent use (APT 2000; ISTAT 1999; Patterson et al 2005).

Accommodation, land use, utilities and waste

Tourist accommodation refers to the built-up area required for rooms, apartments, activities, roads and the energy land to account for energy use (electricity, heating gas and water consumption). More than 90% of lodging facilities in Val di Merse are categorized as home stays or agrotourism. For this reason, I standardized all facilities, in contrast to previous studies that based their calculations on a graduated “star” system of beach resorts (Gössling et al. 2002b). While energy use for laundry purposes is normally large component of tourism environmental assessments, water and electric use were not augmented because lodging facilities collect linens on weekly, rather than daily basis- as a resident household. Data for land use was analyzed via CORINE land cover analysis (Administration Provincial di Siena 1996) of tourist structures, plus resident proportional use of vineyards and olive groves. Per capita consumption of heating gas (GRTN 1999) municipal water (Acquedotto del Fiora 2001) and waste were calculated by dividing domestic and municipal consumption by total equivalent and local residents.

Previous studies have found waste to be an important environmental pressure especially due to Siena’s day-tourism (Gambassi 2003), yet to our knowledge it has not received treatment in other tourism EF’s. Observations have been made that tourists tend to produce less daily waste than residents, with a peak (high waste production) on checkout day (Rhyner 1995). However, no argument could be found

that tourists produce waste in different quantities than residents (Gambassi 2003), so I assigned equivalent waste production values.

Local travel

Local travel represents the principal tourist activity in Val di Merse (e.g., visiting local villages or rural attractions). Respondents were presented a map to indicate itineraries and driving distance considering destinations within the valley. This information was compared with interview responses from proprietors of Pisa airport's seven car rental companies, for an average driving distance of 100km/day. Rental car spending includes minimum insurance, but excludes additional insurance, repairs, etc. This figure plus petroleum consumption was converted to EF equivalent hectares using household auto values as estimated by Chambers et al. (2001).

Activity

Generally a high contributor to tourist impact, this category refers to energy and materials used for entertainment and souvenir purchases. The entertainment category includes visits to museums, shopping, and the acquisition of typical products¹³.

Activities were estimated from interviews, while average daily energy allocations were assigned as an average between four principal values: museum visit:

10mJ/tourist (60 percent electric, 40 percent gas), farm visit: 7 mJ/tourist (70 percent electric, 25 percent petrol, 5 percent gas), tourist shop: 0.8mJ/tourist (60 percent electric, 40 percent gas), and horseriding: 0.6mJ/tourist (15 percent electric, 80 percent petrol, 5 percent gas) (values from Becken and Simmons, 2002).

¹³ A *typical product* is produced in a regulated manner in accordance with how it is typically produced in a given region. This is in contrast to a *traditional product* must be produced according to artesial standards which have historical precedent.

Souvenir purchase estimates were derived from interview responses (Patterson 2005) and tourist expenditure data (APT 2000). Products were assigned EF values according national ecological footprint accounting for the same products (i.e., olive oil, pasta, wine, cheeses, clothing, and wood, leather and paper).

Section 3: Results

As an abstraction, the ecological footprint has the obvious drawback that it can only serve as a model of consumption and waste production. Typically data sources are civil estimates and do not provide sample sizes or ranges, while values of various materials are assigned relative weights. Although consumption weights are routinely peer-reviewed (WWF 2002) and are well accepted for comparisons among populations such as those between countries, values cannot be used to provide a valid statistical test of difference between populations. With these shortcomings in mind, the EF model does provide common denomination and insights which could otherwise not be realized, detailed here.

All of the respondents who were approached completed the interview. The average respondent was 46 years of age, married with one child, traveling in a group of 3. Of the 220 respondents, most originated from Italy (62), followed by France (43), Netherlands (31), Germany (20), Britain (16), Sweden (12), United States (9), Belgium (9), Denmark (8), Other (5), Norway (4), Austria (2), and Canada (1). Reported average daily travel distance was 75 km/day, although interviews with car rental companies and the distances indicated by the places visited on the map

indicated that 100 km/day was more realistic as a conservative estimate. 84% of respondents were staying within the Val di Merse, of that percentage 74% in agrotourism structures and 26% in rented apartments. None indicated friends or hotel as their place of lodging. Of the remaining 16% of tourists lodging outside the Val di Merse: 54% lodged in agrotourism, while 20% lodged in a hotel, 17% lodged in rented apartments, 9% with friends. The great majority of respondents took their breakfasts at the place of lodging (83%) while the remainder stated “bar”. Lunch was nearly evenly distributed between “bar” (36%) “restaurant” (25%), and “bag” (39%). Dinner was taken more commonly at “restaurant” (74%) than “place of lodging” (26%). Typical souvenir purchases (listed in order of frequency of response) were listed as: wine, olive oil, cheeses, paper products, wood handicrafts, leather products, clothing items, and terra cotta. Activities (in order of frequency of response) were listed as shopping, farm visits, museum visits, hiking/horse riding.

From a purely local perspective, “agrotourism” structures and activities do tend toward relatively low energy and resource use. This factor combined with the origination of Val di Merse’s tourists from mainly Italy or Europe, results in a generally more eco-efficient tourism than other documented cases (Gössling et al. 2005). Excluding arrival transport, the EF of a tourist equivalent resident (5.36 gha/person) is only slightly higher than that of local residents (5.47 gha/person), as we can see from Fig. 5.1 (standard EF practice is to report EF results to two decimal points).

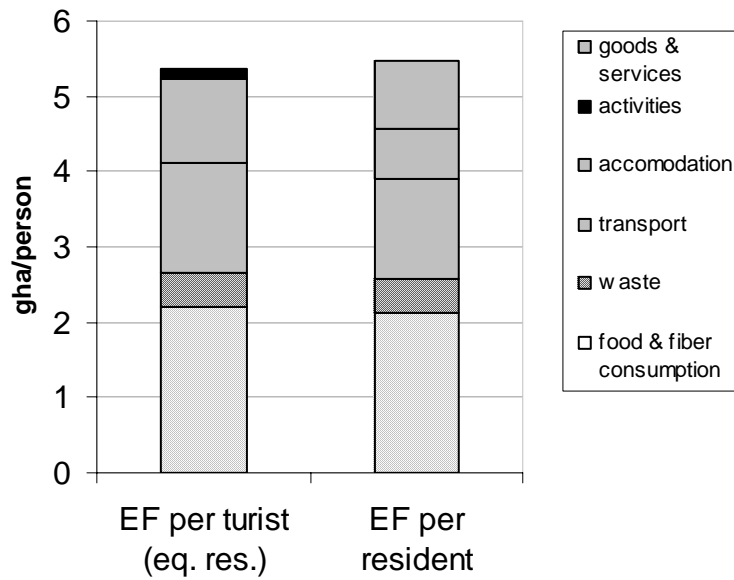


Fig. 5.1. EF tourist vs. EF resident in gha/person, arrival transport is excluded.

The most apparent difference between tourists (considered as an equivalent resident) and local residents is the impact due to local transport. This value can be compared with the ecological footprint of the average inhabitant from foreign countries of origin, weighted by their presence in Val di Merse at 6.7 gha (Fig. 5.2).

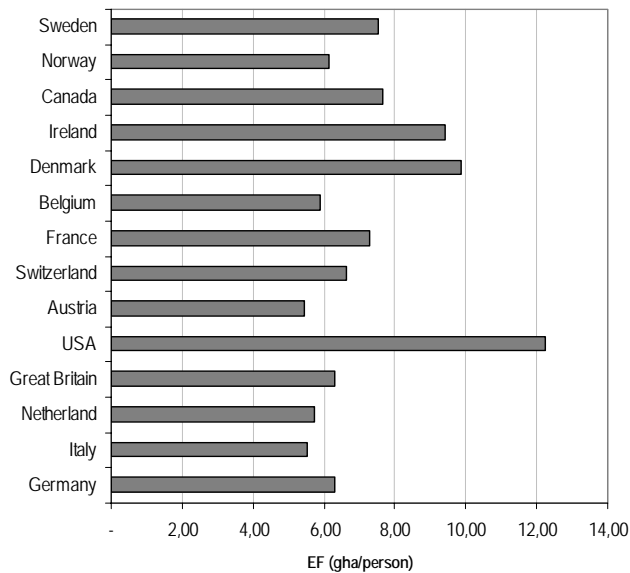


Fig. 5.2. National rankings of ecological footprints, by country (WWF 2000).

In terms of caveats it should be mentioned that one limitation of this calculation is that the number of equivalent residents T tends to underestimate tourist infrastructure and land use at any point in time, as tourist arrivals are typically not distributed evenly throughout a year. For example, only 685 beds may be required in equivalent resident terms, but because arrivals may double during a peak season, the necessary number of tourist beds is actually be higher. Furthermore, my calculation of equivalent residents does not include the consumption by day-tourists (i.e. those who do not overnight). While little day tourism passes through the area, it is doubtless a more significant factor for continental destinations than for islands.

Section 4: Discussion

Tourism is generally viewed as a highly consumptive industry with a substantial share of destinations operating at less desirable eco-efficiency values than the global average (Gössling et al. 2005). This conclusion also applies to the Val di Merse when one considers international arrival travel. When considering purely local impacts, however, this case study contrasts what one might expect from environmental pressure due to tourism. The Val di Merse is a rare example of a destination where tourist and local resident consumption are similar, both levels being lower than the ecological footprint of tourist country of origin. This finding suggests that certain forms of tourism support tourists in consuming more on vacation than at home. While this study was not performed as a study of either utility or satisfaction, the high level of repeat visitors to Val di Merse can be interpreted as a favorable utility/cost ratio.

Throughput reduction is an important goal, warranting some additional speculation here on reasons for lower consumption. Several features incline this destination toward lower environmental pressure due to tourism; which can be named as climate and infrastructure, products, activities, and cultural strength.

First, it must be mentioned that Tuscany's *climate* is known for its ambient temperatures. Energy efficient *built infrastructure* is also a necessary component. While climatic extremes occasionally occur, traditional Tuscan architecture is older stone houses with thick walls and small windows. These are highly effective in controlling temperature. *Cultural infrastructure* cannot be overlooked as daily home economy governs habits, for example, diurnal opening and closing of window covers. Lastly, *informational infrastructure* can provide rapid feedback to consumers and likely encourages tourists to lower consumption. For example, some structures have pay-per-unit of heating fuel and electric. Combined these factors result in a much lower EF due to tourism housing.

With respect to tourism purchases, locally produced *product offerings* appear to be at a sufficiently high quality and attraction. Many agricultural products are organically produced and because agriculture dominates the lifestyle, local, traditional products also are of lower impact. Diet is also well integrated with traditional and organic local agriculture, and Tuscan menus are typified by a rigorous home economy and garden grown or local foods. Unlike mass tourism which often supports enclave resorts, a

supply of food from the tourist's home country is not readily available and this also contributes to a low EF levels.

The tourist *activities* offered in a given destination are also of great importance to the overall environmental pressure generated by tourism. In Val di Merse, the activities which take place are of low energy and environmental impact, such as walking, biking, agricultural tours and horseback riding. These co-exist well with the local culture and natural settings, and require relatively low levels of fossil fuels.

Coordinated efforts have taken place in Val di Merse to retain the tourist attraction within the valley, especially with gastronomic festivals, bicycle and hiking routes.

Lastly, an interesting area for future research is the issue of *relative cultural strength*.

This is relevant to explaining why one culture might transmit the “trendiness” of highly consumptive habits to another. While this “demonstration effect” tends to bring tourist habits to the host country, Tuscany seems to transmit its consumption values to its tourists. Models of human agency suggest the dispositions (as opposed to destinies) we inherit (Rose 1995) relate our ability and propensity for learning; responses depend among other things (innate) disposition, learned behavior, and environmental factors (as reviewed by Jackson 2002). While this last category frequently refers to natural and influences, the cultural environment in which consumption patterns form may prove to be a valuable key to the necessary step of redesigning the process of needs- satisfaction.

Demographics of the host and visiting population are of some consideration to consumption patterns. We note a particularly high proportion of elderly among the host community. This may imply a predisposition to consume less, or make the host community less likely to adopt trendy consumption patterns from its visiting population. Regardless, visitors are attracted to the area for the visible strength of its traditions.

Cultural strength may be important as trends and images influence consumption habits. Other motivations may be constraint (i.e. there are not other alternatives), or social pressure. This remains a subject for further study- but given the urgent need that social vectors be identified for favorable ways to reduce throughput, this chapter suggests that cultural comparisons of consumption patterns and adaptation be pursued.

Despite some of the findings above, it bears repeating that even though the values which categorize Val di Merse tourism are comparatively low (Gössling et al. 2005), it still exceeds that level which is available per capita world wide. The exploration of the ecological footprint here reported, as compared to Provincial ability to support it will be reported on in ulterior studies.

Section 5: Summary

This case study documents a group of tourists consuming similarly to the Val di Merse destination host population. It is therefore plausible that the visitors may be

adapting themselves towards lower local consumption patterns. The contribution of climate, built, social and informational infrastructure and the availability of local products, low-intensity activities, and relative cultural strengths are some reasons for lower levels of tourist consumption. Historical and traditional factors explain the predisposition of Val di Merse tourism to supporting lower impact tourism, and the area's ability to provide these services without a corresponding rise in price. Tourism resource consumption may be more elastic than previously thought, which suggests that socio-cultural or anthropological studies involving the relative strength of host and visitor cultures might provide fertile insights to the consumption/utility debate.

Direct data collection from tourists has allowed a high degree of specificity with respect to tourism habits and ecological footprint estimation in comparison with that of local residents. As a result, civil data improvements may be accomplished by subtracting out tourist consumption, providing the local community and administrators to take a quantified and critical look at what might be some consequences of increasing the tourist population in the future.

The reduction of consumption is an important subject. While this is not a valid statistical comparison, and does not begin to compare satisfaction or utility levels, it does suggest a unique case by which visitors may satisfy their needs and at the same time reduce their consumption levels, at least for a period of time. Whether tourists maintain some habits when they return home (for example, using the blinds rather than the air conditioner, using new cooking methods, etc) - remains an area of future

study. Even eco-tourists cause exceptionally high environmental pressure via arrival transport. To support an ecotourism establishment's claim of being truly sustainable, one is left with few options but to suggest that structure orient itself around the long-term reduction of daily consumption once their tourists arrive home.

This paper can only provide cursory suggestions for how to approach studies of throughput reduction in the future, but point to the significant inroads to be made with quantified and controlled studies in consumer psychology, utility and satisfaction. Tourism provides countless opportunities to explore the confrontation of consumer cultures for more extensive study. Max Neef (1991) in attempting to re-characterize fundamental human needs stressed the importance of "distinguishing between needs and satisfiers" the former which are universal and finite, the latter which vary widely and are potentially infinite in time and across cultures. The multiplicity in satisfaction is a critical key by which we can expect to make some headway in reducing economic throughput, and is an area worthy of much future study.

Chapter 6: The EF in Determining Tourist Carrying Capacity

*When preparing to travel, lay out
all your clothes and all your money.
Then take half the clothes and twice the money.*
Susan Heller

This chapter takes the theme that tourism- even sustainable tourism might be costing more than first accounted. Estimates of how much the earth can “afford” in terms of a population and its associated consumption has to do with carrying capacity. Carrying capacity is the quantity of population or activity that an ecosystem can support indefinitely without compromising its ability to deliver ecosystem goods and services to that population sustainably (Rees and Wackernagel as cited by Deutsch et al 2000). The ecological footprint is a conservative estimate of human pressure on global ecosystems assessing human use of natural capital by comparing resource consumption and waste production to the regenerative capacity of the Earth. While not a complete description of carrying capacity, biocapacity provides some indication of a territory’s stock of natural capital. A comparison of biocapacity with the ecological footprint indicates whether the net consumption level surpasses or is within the bounds of the area’s ability to supply natural services originating from local ecosystems. As a very crude measure, this comparison gives some indication of carrying capacity for various consumption levels and populations, and a starting point to discussion of how much tourism development a community can “afford”.

Section 1: Tourism Carrying Capacity

In tourism literature, tourism carrying capacity (TCC) is defined as “the amount of tourism damage a site can assimilate without long-term damage – which can be measured against the total number of tourists using the site to determine whether the social optimum has been exceeded and the site is being over-utilized” (Steele 1995 p32). Another definition is posed by the World Tourism Organization: the tourist carrying capacity of destinations is determined by the number of persons which could visit a location within a given period, such that local environmental, physical, economic, and socio-cultural characteristics are not compromised, and without reducing tourist satisfaction (WTO 1999).

Pearce (1989) defined carrying capacity as the threshold of tourist activity beyond which facilities are saturated (physical carrying capacity), the environment is degraded (environmental carrying capacity) or visitor enjoyment is diminished (perceptual or psychological carrying capacity). Other evaluations of destination carrying capacity have titled these *ecosystem capacity* (a locale’s available natural capital, in relation to use patterns) (Collins 1999), *aesthetic and experiential capacity* (a measure of visitor satisfaction), and *socioeconomic capacity* (a measure of the social and economic satisfaction of local populations, in relation to tourism development) (Satta 2003) in relation to typical use patterns.

In other words, local carrying capacity is a function of given consumptive patterns, within the context of local social, economic, and biophysical limits (Bimonte and

Punzo 2004). The notion of a physical limit refers to the level of tourist visitations beyond which resources can be irreversibly damaged and the perceived cost tends to the infinite¹⁴. The second, the economic limit, refers to the level of use above which the quality of the tourist experience declines so much that it results in a reduction of total value derived from tourism (seen as a reduction in total willingness to pay). The third limit is that point above which the social perceived costs of the host population tend to surpass the benefits, with the consequence of impinging on quality of life (Costa and Manente 2000).

A great challenge is that conventional TCC analysis is limited to the scale at which the direct impacts from tourism can be observed, recorded and controlled – in effect, the destination locales. This spatial limitation means that successfully staying within local carrying capacity does not necessarily imply that tourism is sustainable at a global scale. By limiting our analyses of tourism impacts to local assessments, there is no basis for discussions of impacts tourism and travel has elsewhere than the destination itself. While carrying capacity is seen as a valuable tool for the management of tourism growth (Stankey 1979 as cited in Lindberg (1997)), Collins (1999) notes several obstacles to reconstructing, transplanting or restoring degraded natural capital. Noting that the actual TCC is unknown for most destinations, he poses the question “*how does one gauge whether tourism development is unsustainable?*”

¹⁴ Conventional economic interpretations rely more on the reversibility of these decisions, and as one could discount future costs, they could be seen as less than infinite. However, ecological economics holds that even a small cost over limitless generations is infinite, and many of these decisions are irreversible- that is, they entail notable thresholds where marginal costs rise dramatically and persist forever.

(ibid). Quantifying tourist impact, comparing it to local residents and the destination's biocapacity, while crude, can be a first step to answering this question.

While tourism researchers have little awareness of the impact of tourism at the global scale, they also lack the capacity to track how global changes effect destinations (Patterson 2003). This means that supporting the local carrying capacity could lead to problems in the future if global level environmental degradation is causing unseen stress on the destination. When system states are not observed at all relevant scales, a gap emerges in feeding back information to destination managers (ibid). This holds in both spatial and temporal frames – missed observations within appropriate timeframes can produce critical response lags (Hughes 2002) and can lead to the overshoot of carrying capacity of a tourism destination which would otherwise not be detected. This chapter employs the ecological footprint of tourism and biocapacity in the role of what Pearce (1989) above termed *environmental carrying capacity* for tourism.

Section 2: Biocapacity in Val di Merse

This discussion takes the same data collected from the previous chapter, and discusses it within a slightly different context- namely widening the scope of discussion to carrying capacity (in terms of biocapacity) and to the tourism impacts which take place not just at a local, but global scale.

Resident consumption levels were weighted by population in the four Commune of Val di Merse. Based on an average resident EF of 5.47 (See Appendix 2), three of the four communes in Val di Merse have a biocapacity in excess of the EF of the local residents (13.5, 12.3, 10.6, and 3.6 gha) in Chiusdino, Murlo, Monticiano and Sovicille respectively for a weighted total of 6.9 gha (see Figure 6.1). This suggests that the environmental systems of Val di Merse are able to support some additional consumption impacts (i.e., tourism). Both areas, the Val di Merse and the Province of Siena, have biocapacities in excess of what is used by local residents. This is an increasingly rare character in Europe for a destination, and is due to 1) the fact that many towns are walled, limiting their sprawl and concentrating throughput, and 2) the remnants of locally productive and diverse agriculture have meant little imported agriculture for consumption.

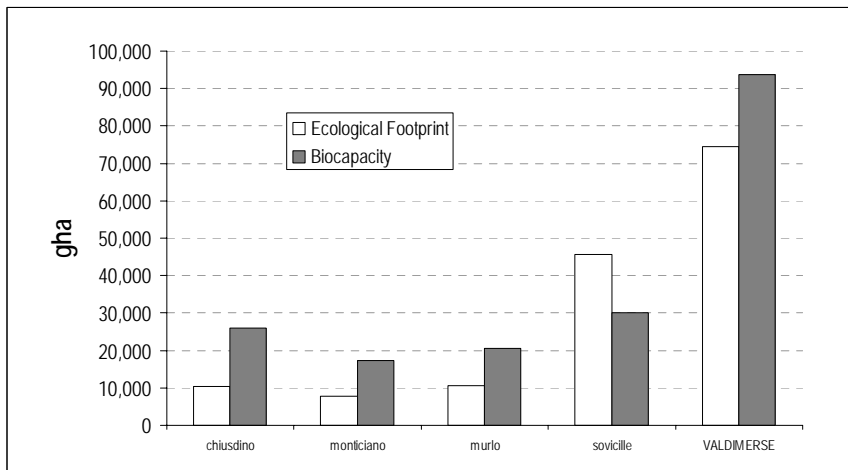


Figure 6.1: The comparison between the Ecological Footprint of the specified areas and the local Biocapacity. This figure does not include the tourism contribution to Ecological Footprint values.

Section 3: The EF of Tourism and Arrival Transport

When only the local impacts of Val di Merse tourism are considered, the cumulative EF of residents and equivalent inhabitants 7.1×10^4 gha is below the calculated biocapacity of 9.4×10^4 gha (see Figure 6.2). The fact that the current population and consumption level of the population is below the biocapacity carrying capacity of the study area give some indication that the tourism population can be increased without risking degradation of the area's ability to deliver goods and services sustainably.

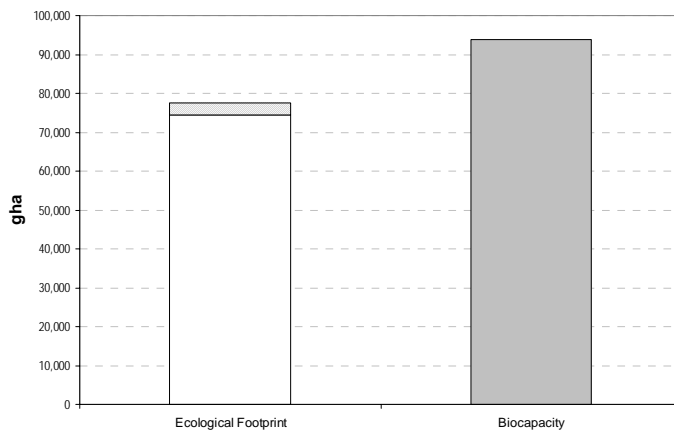


Figure 6.2: The comparison between the Ecological Footprint and the Biocapacity of Valdimerse. The EF represents residents (white) + tourists (striped), yet does not include arrival transport.

However, this description is not complete, in particular because we began this chapter with a discussion of some dangers of basing management decisions only on local observations of impacts. It was mentioned in chapter 2 that an ecological economics approach to sustainable tourism analysis would account for *_all_* impacts, including those affecting other parts of the globe. By some accounts, this means impacts begin when tourists leave their home countries.

The picture of tourism impact changes radically once we begin to include those of airline travel. At 33gha per equivalent resident annually, arrival transport provides 86% of the environmental pressure (38 gha total) due to tourism to the area (Appendix 3). When we take a look at the quantified impact of each portion of consumption, the importance of accounting for and assigning responsibility for arrival impact becomes clear. On average, over *four-fifths* of tourism impact is caused by arrival travel. This reconfirms conclusions drawn from studies of “mass tourism” destinations by Gössling (2002b; Gössling et al 2005; Hunter 2002), yet is even more striking when one considers that the primary motivation for arrival to Val di Merse is “agrotourism”- otherwise known as a form of ecotourism.

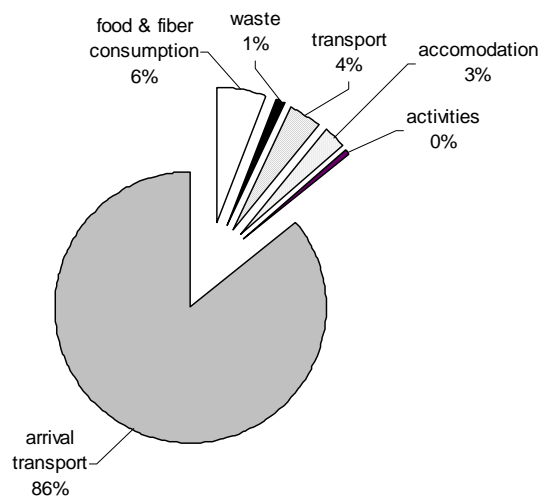


Figure 6.3 Relative percentages of the ecological footprint of tourist (as equivalent resident) impact, by impact category.

A quantified look at tourism arrival emissions raises important questions of responsibility for global emissions. For the sake of assigning full responsibility for local economic activity, we can redraw the ecological footprint/biicapacity

comparison with this added information. The total environmental pressure due to tourists plus residents of 1.0×10^5 gha is now seen to exceed biocapacity 9.4×10^4 gha for the study area (Figure 6.4).

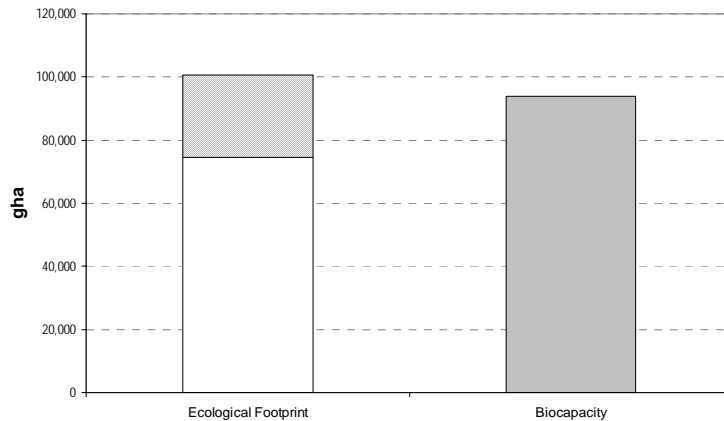


Figure 6.4: The comparison between the Ecological Footprint and the Biocapacity of Val di Merse. The EF represents residents (white) + tourists (striped) and includes arrival transport.

Section 4: The Eco-efficiency of Tourism to Val di Merse

One way to contextualize these results, in presenting alternatives for tourism development in Val di Merse, is to weigh the costs and benefits of tourism with two simple proxies: CO₂ equivalent emissions; and local spending. While this may oversimplify the situation, it may assist in some discussion of alternatives for local policymakers. The goal of this section is to be able to compare the *ecological efficiency* of tourism from source countries (a function of CO₂ emissions) to the revenues generated by visitors from those countries. Results from this section receive more complete comparison with other destinations in the article I published with Gössling et al (2005).

Eco-efficiency is an attempt to compare environmental impact with the use of resources, based on an assessment of a process lifecycle (Cramer 2000; Dober and Wolff 1999; as cited in Gössling et al 2005). Carbon dioxide equivalent (CO₂-e) emissions are used as a proxy for environmental damage on the global environment. As a proxy for value generation, Euro turnover is used. Eco-efficiency is thus the ratio of CO₂-e (kg) to turnover (€). This analysis does not include consideration of tourism multiplier effects (ie. secondary impacts of tourism on the economy). Eco-efficiency is used as a tool to make some of the points derived from the ecological footprint analysis more relevant to considerations currently being discussed in developing Siena's provincial planning for sustainable tourism.

Assessment of the costs and benefits of CO₂ equivalent emissions can be based on either that due to arrival transport alone (see Figure 6.5), or to the emissions of both arrival transport and local housing, weighted by the length of stay (see Figure 6.6).

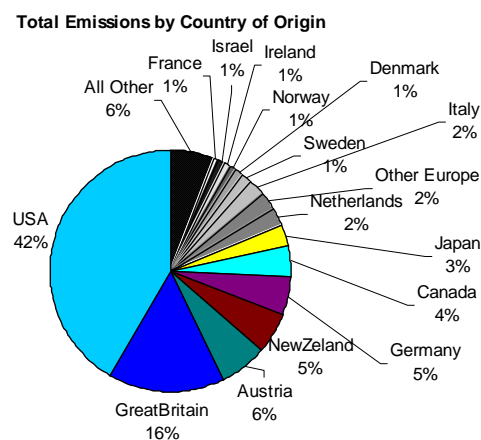


Figure 6.5 Total emissions by country of origin due to arrival transport to Val di Merse

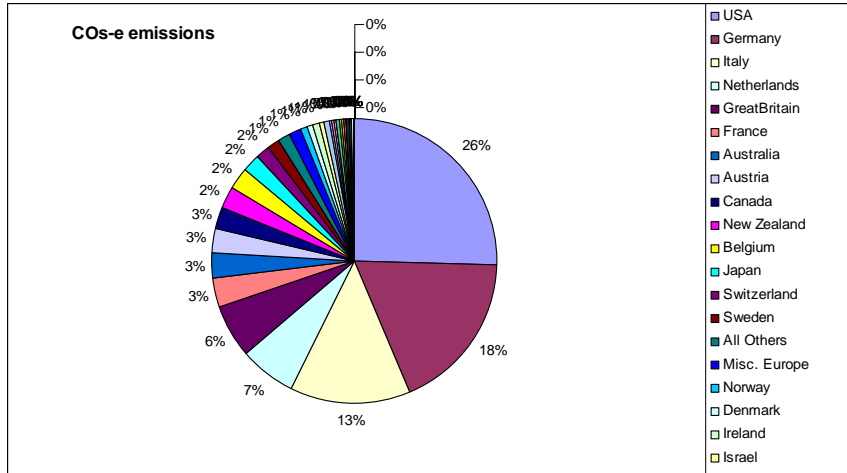


Figure 6.6 Carbon dioxide emissions by country of origin, including emissions from lodging.

The weighted carbon dioxide-equivalent emissions (CO₂-e) from arrival transport and accommodation (see Figure 6.6) reveals that the largest GHG contributors are visitors from the United States USA (26 percent), Germany (18 percent), Italy (13 percent), The Netherlands (7 percent), and Great Britain (6 percent). Of the remaining 30 percent, almost half are from other European tourists. These calculations are based on an overall average of 20 kilograms CO₂-e per night for accommodations, with emissions from arrival transport weighed against an average length of stay in Val di Merse of 5.35 days.

Comparing these figures with local tourism revenues, a typical Val di Merse tourist spends €69 per day, distributed among various use categories (see Figure 6.7). According to driving distance assessed in chapter 5, local gasoline consumption was added to miscellaneous combustibles, but arrival to Val di Merse, car rental costs are not included (about 30 percent of Val di Merse visitors rent cars, paying on average €30 per tourist per day.) The total local average revenues are thus €72 per visitor-day

for accommodation, food, activities and car rental (again, pkm is passenger kilometer). €0.05/pkm was assumed for transport revenues.

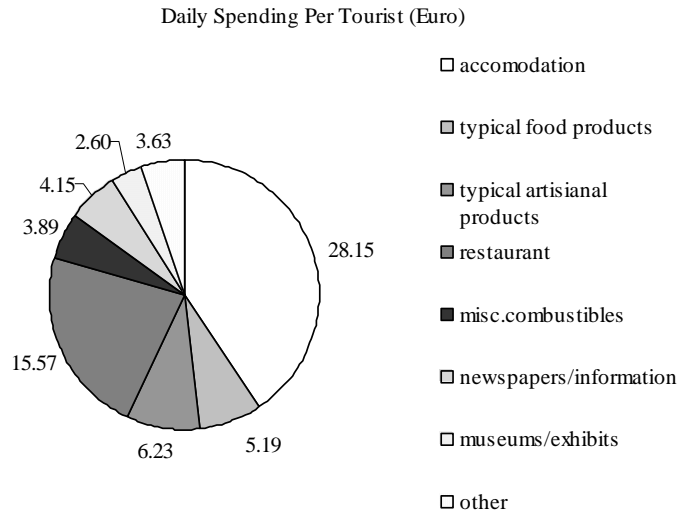


Figure 6.7 Budget for an average tourist to Val di Merse (APT 2000)

The total local spending by nation is presented in Figure 6.8. Eco-efficiency appears to range between 0.4 kg CO₂-e per Euro for Italian visitors, to 4.0 kg CO₂ -e per Euro for Australians and New Zealanders (higher CO₂ figures being less desirable). When all accommodation emissions and arrival transport revenues are included, the value is 0.85 kg CO₂-e per Euro, a figure which is lower than all other known European cases (Gössling et al 2005). This is likely due to the rather low share (10 percent) of non-Europeans visiting the area.

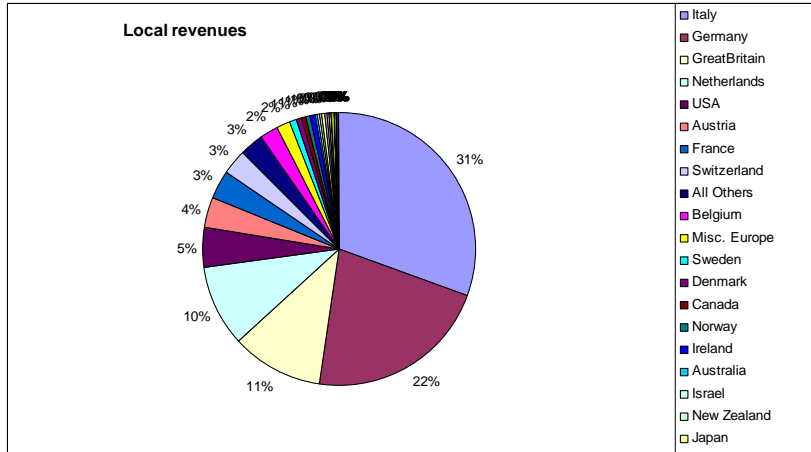


Figure 6.8 Local revenues due to tourist visitation from various countries.

To understand the tradeoffs this presents for Val di Merse tourism (in comparison with other sectors), we can look at the GHG balance provided for Chiusdino (see Figure 6.9) (SPIn-Eco 2002). While Chiusdino had only 11,149 visitors in 2002, the airline emissions from those visitors comprise over one-quarter of total GHG impact of the commune. Comparing the equivalent tourist population of 241 with the host population, we see that less than one-eighth of the effective population produced more than one-fourth of the commune’s total environmental impacts.

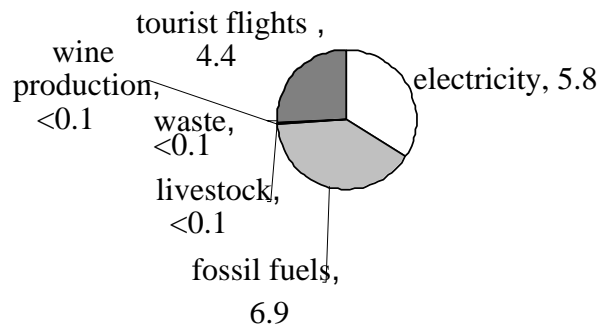


Figure 6.9. Green house gas emissions, as calculated in (SPIn-Eco 2002), according to IPCC guidelines 1996. Tourist flights (not accounted for in the guidelines) were calculated by (Patterson 2004).

When compared to the percentage of local income derived from the tourism sector, attention is drawn to tourism's generally low eco-efficiency (see Figure 6.10). It should be noted however, that Chiusdino is a net carbon sink – its forests absorb 60.4 Gg of carbon per year, and can be considered part of the local attraction for tourism (SPIn-Eco 2002).

Percentage of local income derived by sector

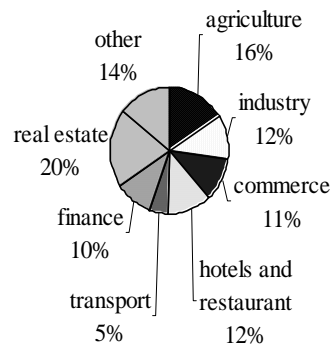


Figure 6.10 Contributions to the local Chiusdino economy by various sectors (SPIn-Eco 2002; Provincia_di_Siena 2003). Small amounts of CO₂ produced by wine fermentation were accounted in the category of “industry”, whereas all other agricultural emissions were tracked by fossil fuel use.

Section 5: Chapter Conclusions

This chapter compared tourist and resident environmental pressure to biocapacity, as a first step in bringing quantitative measure to the concept of tourism carrying capacity. Simply considering the local impacts of tourists and residents, it appears that Val di Merse's stocks of natural capital (as measured by biocapacity) are sufficient to support this population at current levels of consumption. However, this description is not complete because it does not account for unsustainable activity taking place on “hinterlands”, and limiting consideration to local impacts excludes arrival transport- a significant source of emissions. When quantified, arrival travel

constitutes on average over 86 percent of tourism's eventual environmental impact. If this source of emissions is included, the combined population and resulting environmental pressure in Val di Merse can be considered to be slightly over biocapacity.

This chapter reported that local impacts of the Val di Merse tourism industry are generally lower than those of other destinations (Gössling et al 2005). Typically, the tourism industry is cast as a 'benign' or 'smokeless' industry (OECD 2002). Yet an ecological economics approach demands addressing all sources of environmental pressure (even those that occur at distant areas) which directly or indirectly supports the local economy's ability to gain from tourism. Once the full extent of these impacts is quantified, it becomes clear that tourism is not as eco-efficient as is often assumed. If tourism planners and investors are committed to strong sustainability, this issue will be weighed against other costs and benefits of tourism development. As a first attempt at showing an example of how this might be done, this dissertation has gone about the process in two steps: first, comparison of the energy/material/waste intensity of both tourists and residents; second, an assessment of the contribution of tourism to local economies, considering whether economic benefits are in balance with the expected ecological costs.

One policy option may be to promote more tourism from local countries or within Italy (i.e., orienting promotion around nearby countries vs. Japan or the U.S.), or provide incentives for longer stays (Gössling et al 2005), or local products low in ghg

production (ie. wine). An ecological economics approach to sustainable tourism requires that responsibility for emissions be shared among those who benefit from tourism. Whether the greater part should be borne by tourists' countries of origin or with the host community is an issue currently being debated among members of a tourism and climate change network (Amelung 2004). Clearly, basic information about the nature and extent of those impacts is critical to an appropriate resolution to these problems.

Tourism emissions influence the global biosphere, and are thus likely to produce unexpected changes in locales that are not tourism destinations. This Val di Merse case study is just a good example of how an exclusive focus on direct and local impacts of tourism may omit the global impacts of tourism. At this point, local destinations have little incentive to sacrifice short-term revenues for a larger public good. This issue will be covered in more depth in chapter 8, but first chapter 7 explains the significance that local and global ecological footprints of tourism are so different.

Chapter 7: Local versus Global EFs of Tourism

*“For I dipt into the future, far as human eye could see,
Saw the vision of the world and all the wonder that would be;
Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight, dropping down with costly bales.
-From “Locksley Hall”
Alfred, Lord Tennyson, 1842*

Up until now, this dissertation has covered the use of the ecological footprint as an indicator of tourism carrying capacity at local and global scales. This chapter discusses the social perception of carrying capacity, the point beyond which a society is able to express that net social costs are exceeding net social benefit. Ecological economics and conventional economics treat these two as very differently, and communities may not be as prepared to gauge social carrying capacity as they might believe.

Is it so serious that tourism to a destination might lead to pressure on the global carrying capacity? I discuss the specific example of airline emissions, and illustrate some of the consequences (in terms of pressure on the global environment) when local activity begins to impact global public goods.

Section 1: Carrying Capacity as a “when to stop” Rule

One day, at a busy airport, passengers were taking their seats. The pilot and copilot enter finally the back of the plane, and make their way slowly up the center aisle to the front of the plane. Both have sunglasses and seem blind, one has a cane and

bumps into several passengers- the other has a guide dog.

At first, no one moves, thinking that it must be some sort of practical joke. But pretty soon, the engines start up, and the airplane starts to move down the runway. The passengers begin to look worried, whispering to each-other and asking the stewardesses with some concern. The plane starts accelerating, and people start to become panicked, some of them praying and others yelling. As the plane gets closer and closer to the end of the runway, the people are nearing total hysterics.

When the plane has less than 10 meters of runway left, there is a sudden change as everyone begins to scream urgently. At the very last second, the plane lifts off and is airborne. In the cockpit, the copilot gave a sigh of relief and tells the pilot: "You know, one of these days the passengers aren't going to scream, and we aren't going to know when to take off!"

Brian Czech's book "Shoveling Fuel for a Runaway Train" (2000) made the analogy between blindly accelerating a vehicle and an economy lacking needed direction. This chapter discusses some of the dangers involved when public awareness, and eventual outcry, is used as the guiding indicator to determine a carrying capacity for tourism.

Chapter 3 discussed the pertinence to sustainable scale in having specific limits upon which economic growth is no longer beneficial. In terms of tourism, many practitioners associate these limits with indicators assessed at the local level (Punzo

and Bimonte, 2004). Some practitioners argue that tourism will not exceed local biophysical carrying capacity because although economic incentives may increase tourism to unsustainable levels, the operative “when to stop” mechanism is social carrying capacity (SCC) (ibid). They claim that empowered host populations will observe local impacts, protest, and thereby induce changes to tourism policies. In conventional economic terms, the critical inflection point occurs when tourist satisfaction is reduced and registers on their marginal willingness to pay (WTP) (Lundberg 1995). Figure 7.1 is the graph of an economic interpretation of the Butler cycle discussed in chapter 2 (Bimonte and Punzo, 2004). Once visitation volumes have exceeded LCC, the total revenues decline, due to either lower WTP (i.e., willingness to pay premium prices to visit impacted sites), or from an overall decline in numbers (Butler 1980).

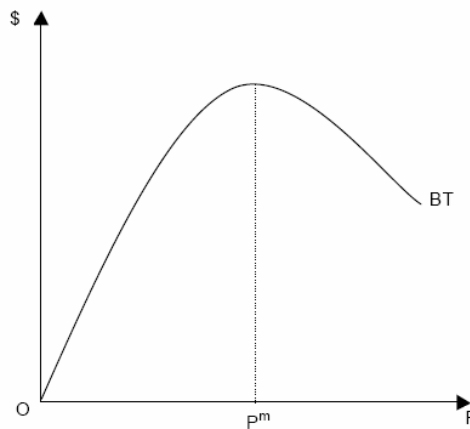


Figure 7.1 Curve of total net market benefits (x-axis is tourist *presence* – the number of bed-nights, y-axis is total revenue).

Net social benefits will be maximized at the point where the net market marginal benefits are zero (i.e., the benefits associated with each additional tourist are exactly balanced by the costs incurred from their visit, such as crowding or conflict)

(Bimonte and Punzo 2004). Total external costs can also be formally depicted (figure 7.2). Conventional tourism economists note that that the private economic equilibrium (the tourist *presence* is p^m , or the *economic carrying capacity*) is found at visitation rates which are higher than the maximum social benefit (ibid). Economic carrying capacity takes place at the highest possible tourist visitation, before the total net benefits (BNT) level-off. Economic returns decline as destinations are less appealing when crowded, or otherwise suffer severe social or environmental impacts (Mathieson and Wall 1982). In contrast, the socially efficient level of visitation occurs when net marginal market benefits equal the marginal external costs (the tourist *presence* is p^* , or the *social carrying capacity*), at a lower visitation level. Because p^m is usually realized in free market contexts and focuses on maximizing private profit (and not external costs), while p^* is at a lower visitation rate (and supposedly thereby well under biophysical carrying capacity), the commonly preferred approach to safeguarding carrying capacity is to use market instruments to maintain the visitation level at socially acceptable levels.

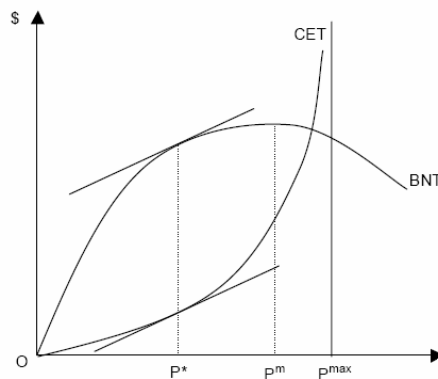


Figure 7.2 Curves of total external costs (CET), total net benefits (BNT) which identify P^* the social carrying capacity (or social optimum), and P^m the market carrying capacity, in contrast to P^{max} , the physical carrying capacity.

However, for social intervention (based on *social carrying capacity*) to properly function as a ‘when to stop’ mechanism, one of two things must happen: host communities must become so distressed as to make the experience less pleasurable for the visitors (Doxey 1975); or, as the level of visitations nears biophysical limits, total costs must rise perceptibly and sufficiently to convince a critical mass of private actors that adding more tourists is counter-productive (Bull 1991). This approach places considerable faith in two things: that social carrying capacity is sensitive to all relevant biophysical limits, and that host populations will perceive local conditions deteriorating sufficiently far in advance to react (Hughes 2002). By the time local biophysical limits (p^{\max}) are apparent to local observation, visitation rates are often greater than the socially perceived optimum (ibid).

Appreciating the differences between global and local sustainability depends on one’s vantage point. From a bottom-up understanding (local-to-global) externalities may exist at global levels, which are not accounted for at the local scale. An ecological economics perspective of sustainable tourism takes a top-down approach (global-to-local) to assessing impacts, advocating that all externalities must be accounted for at some local level. *Without global sustainability, there can be no local sustainability.*

Section 2: Airline Emissions and Tourism Impacts on Global Public Goods

Collins (1999) cited the possibility of ‘downstream effects’ from one tourism region to another. Amelung (2002) suggested that “ecotourism may meet the sustainability

requirements of one scale but cause so many spillover effects that it may not be considered sustainable at others". One reason why market prices are likely to be insufficiently sensitive to biophysical limits is due to impacts at temporal or spatial scales beyond those which can be locally perceived (Collins 1999; Amelung 2002; Ceron and Dubois 2003; Hughes 2002). These impacts may be difficult to directly associate with tourism activity such as impacts that are spatially removed from host community observation. This dissertation has mentioned some of them; for example consumption of imported goods which cause negative environmental consequences elsewhere, emissions which cause radiative forcing, or which follow from subtle changes of another factor (e.g., biodiversity loss from climate or shifting land-use). This section reports on the current state of knowledge about airline emissions.

The by-products of travel (e.g., transport emissions) are a set of tourism-related environmental impacts that are consistently and conspicuously absent from the general discourse on sustainable tourism (OECD 2001; Hoyer 2000). This is despite that the bulk of tourism's contributions to greenhouse gas emissions (GHGs) are derived from transport activities (76.5 percent in the United States (see EPA 2000)). Globally, air transport in particular is a major source of GHGs, accounting for 40 to 90 percent of all travel related emissions (Eurostat 2000). Preliminary estimates suggest that international tourism may account for around 3.4 percent of anthropogenic (i.e., human-generated) global warming (Transport Awareness Tool Kit ELDIS; Eurostat 2000). To put that figure in perspective, it is significantly above the impact of the entire British economy. Cirrus clouds, formed by aircraft contrails,

have recently been found capable of increasing average surface temperatures enough to account for the entire warming trend in the U.S. between 1975 and 1994 (Ayres 2004). In absence of industry controls, the growth rate of the global airline impacts has received little critical attention.

By 2030, annual airline emissions are expected to contribute twice as much to the greenhouse effect as did automobiles in 1990 (OECD 2000)(figure 7.3). Although the capacity for future technological change or shifted demand present a far significant challenges (Airtech, 2001), attempts to construct governance around this issue are rare (Dubois 2001). Despite being a significant contributor to radiative forcing, (OECD 2000) transportation emissions continue to be neglected in the Intergovernmental Panel on Climate Change (IPCC) debates (IPCC 2001; Amelung 2004).

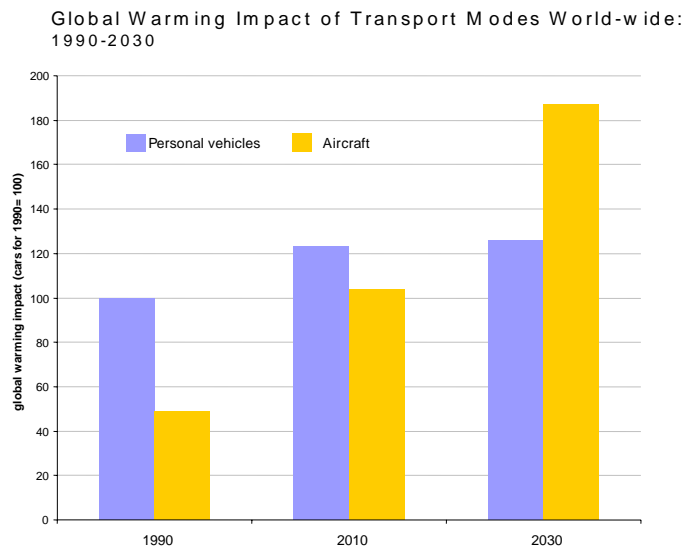


Figure 7.3 Global warming impact of transport modes world wide Sources: (OECS 2000; CST 1999; IPCC 1999; OECD 1995)

Between 2010 and 2040, air transport is expected to exceed road transport as a contributor to global warming (OECD 2000). Yet of nearly fifty tourism sustainability charters and agreements, only two give brief mention of air travel (Dubois 2001). The emissions from international aviation and shipping sectors are exempt from nearly all environmental policy controls (Olsthoorn 2001). The UN Framework Convention on Climate Change does not address emissions from *bunker fuels* (i.e., those sold in harbors, such as heavy shipping oil and jet fuel). By 2030, this means that of the total reduction in global warming emissions to be achieved under the Kyoto Protocol, half will be subsumed by the impact of our growing appetite for airline fuel alone. Globally, a low estimate demand for air transport is projected to increase by 5 percent per annum (WTO 2003). See figure 7.4 (adapted from Amelung 2002), used with permission)) for other current scenarios based on economic growth, fuel efficiency, and Nox reduction.

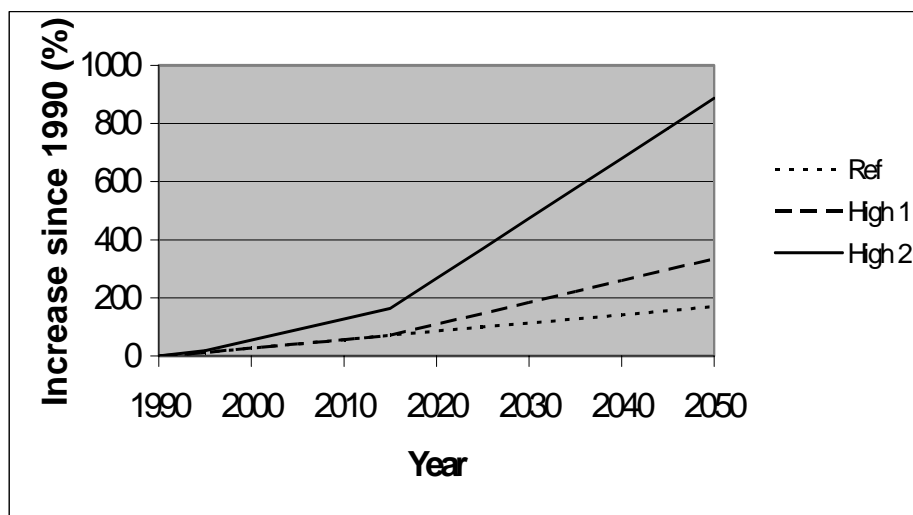
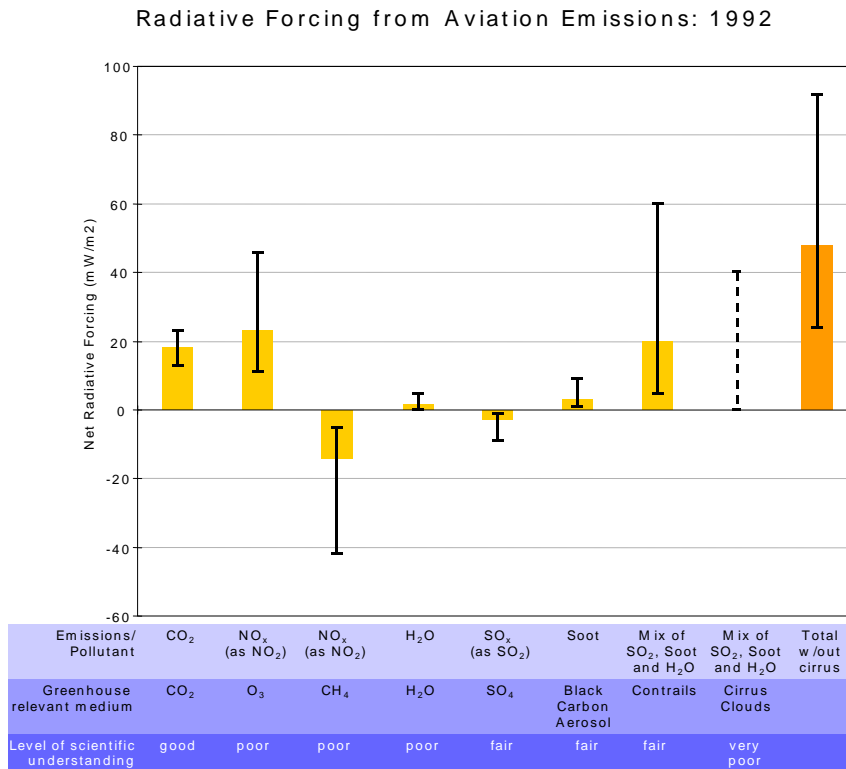


Figure 7.4: Total aviation carbon dioxide emissions resulting from three different scenarios for aircraft fuel use (Ref: midrange economic growth, technology for both improved fuel efficiency and No_x reduction; High 1: high economic growth,

technology as for Ref scenario; High 2: high traffic growth, technology focused on lowering NO_x emissions), source: adapted from Penner (1999) in Amelung (2002).

Technological changes are estimated to increase fuel efficiency by about 1 to 1.5 percent annually over the next ten years (WTTC 2003). These rates are slowed by the slow and costly turnover rate of capital equipment (ibid). Furthermore, scientific uncertainties about the ultimate impacts of emissions make it difficult to assess net social benefits (see Figure 7.5. Even were jet engines to be replaced with hydrogen fuels, researchers state the resulting water emissions would form high cirrus clouds which would also contribute to radiative forcing.



Sources: (OECD 2000) (IPCC 1999)

Figure 7.5: Radiative forcing from aviation emissions, 1992. Scientific uncertainty is particularly high regarding contributions of particle mixtures, and water vapor in formation of cirrus clouds.

Responsibilities for these impacts at a global level are not evenly distributed. While only 1 in 4 Americans travel abroad over the year, they make up a large proportion of the kilometers per year traveled by airplane (fig 7.6, OECD 2001)

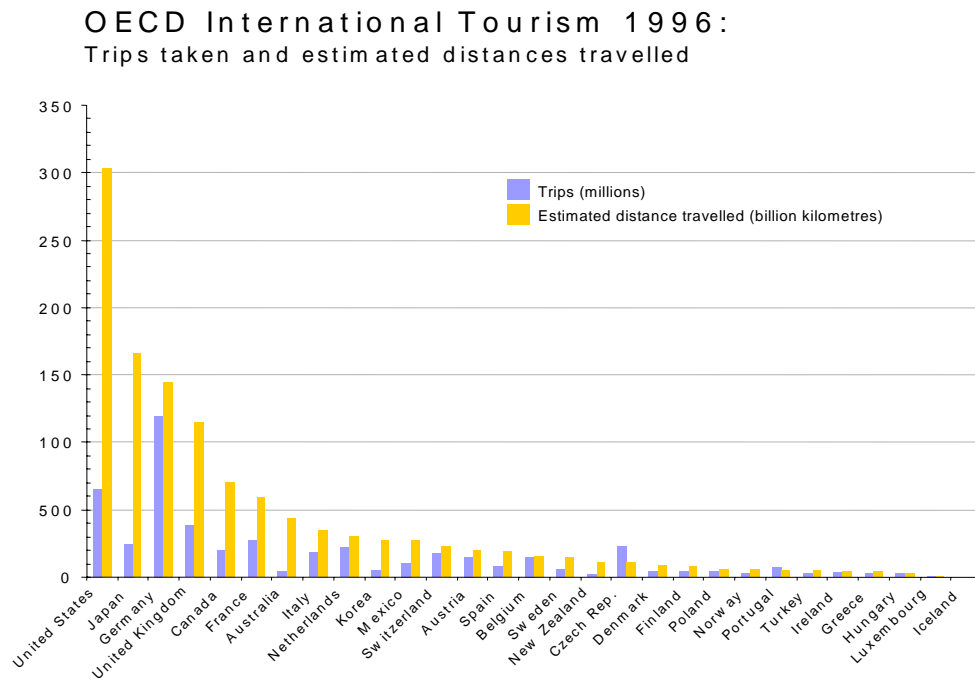


Figure 7.6 source: OECD 2001

Weighing costs and benefits of tourism development effectively relies on complete information. If the objective of defining sustainable tourism policy is “above all ... to *avoid* risk, or to take *calculated* risks with more complete knowledge of the outcomes” (IWGIST 1993), then an ecological economic assessment of the costs and benefits of tourism development need include the impacts of travel, and both local and imported consumption.

The root of the word *travel* comes from the word *travail*. Some time ago, travel was viewed as something dangerous, involving discomfort. Tracing ‘travail’ back to the

medieval period, one even finds a medieval instrument of torture - the *trepalium* (*tres* 'three' and *palus* 'stake'). Becoming a verb, *trepaliare*, referred to any form of torture. This evolved to the French *travailler* - 'putting oneself to pain or trouble, eventually to "work hard"'. The English borrowed the word as 'travail' and eventually became a term to describe a wearisome journey - travel. As air travel has taken much of the physical exertion out of travel, we are no longer so conscious of the physical work by engines, pistons and turbines. This chapter has summarized information on airline emissions which must be somehow assimilated by the environment. Little attention has been given to date on the workload placed on the planet to support human movement and its acceleration. Most environmental indicators are place-based, and therefore have limited applicability to phenomena which is not.

Chapter 8: Realms of Concern and the Tourism/Climate Change System

Let me tell you, Eliphaz, there is nothing more pointless than drawing a map for a man who doesn't have the slightest idea where he's going. You might as well give him a blank sheet of paper and a kick in the pants.

-Jonathan Levi,
A Guide For the Perplexed

The enemy is anybody who's going to get you killed, no matter which side he's on
-Joseph Heller, *Catch-22*.

This chapter deals with one obstacle in setting and achievable goals in sustainability. When “realms of concern” are undefined, decision-makers lack a critical piece of information. Knowledge management can play a role in assisting decision-makers and their stakeholders to be more explicit about their goals- both in terms of where in a process an intervention is targeted, and spatial scale. Up until this point, this dissertation has introduced concepts (chapter 2), described ecological economics as an approach (chapter 3), given a qualitative site description (chapter 4), and quantified tourism impacts in Val di Merse at a local (chapter 5) and global (chapter 6) scale. The importance of one difference between the two scales (airline emissions) was discussed (chapter 7).

In the first chapter, I mentioned that “realms of concern” are important to setting goals for sustainability. This is a relevant discussion because given some of the evidence in earlier chapters, even when destinations are meeting their local goals for sustainability, communities may also be concerned about global goals for

sustainability. However, attention for the relevant scale of sustainability goals is obscured when communities divide themselves along polarizing issues. The issue becomes even more complicated when indicators at local and at global scales do not tell the same story. The difficulty in addressing sustainability goals systemically from local to global scales is one barrier to resolving these disparities.

This chapter suggests that a globally sustainable tourism will only come about when changes are induced and supported at multiple scales, and at multiple points in the cycle of interaction between tourism and the global environment. I will use the example of the tourism-climate change system to illustrate the conceptual shift necessary. A second aim of this approach is so results from the previous chapters can be seen in light of a broader context.

This chapter presents two central conceptual diagrams relating tourism and climate-change. It is essentially a knowledge-management exercise. The first diagram describes a typical polarization in tourism and climate change knowledge management. It is argued that this dichotomy restricts the collective body of knowledge and obscures important causal links between tourism and climate change phenomena. Developments are proposed in a second conceptual model which counters the tendency of scientists, policy makers, the tourism industry and NGOs to polarize along two research interests; climate's influence on tourism vs. tourism's influence on climate; either of which could be interpreted as a primary limitation to the sustainability of tourism. The paper places into context key perspectives in the

tourism/climate change discussions, addresses the difficulty of taking a systems approach to human activity and climate interactions, and draws attention to some underlying drivers of unsustainable trends. New strategic conceptual models are advocated to support long-term non-territorial collaboration, incorporate adaptation and mitigation in ways which are not mutually exclusive, and third, address the following paradox: that the cross-section of the global population driving the demand for tourism resources threatened by climate change, are also disproportionately responsible for increased radiative forcing.

Section 1: Tourism and Climate Change: Two-way Street or Vicious/Virtuous Circle?

The global climate arguably presents the single most problematic environmental change of our era (Sugden et al. 2003). Tourism, as the largest world industry, is growing rapidly, and is sensitive to climate changes in various ways (Amelung 2004; WTO 2003). The characteristics the two research areas share (both are intrinsically global, are tightly linked to resource pressures, and require governance at levels which range from the local to the global) indicate they are also phenomena which generate problems most difficult to solve.

Governance for sustainability entails resolving complex, global, social and environmental problems. This requires providing information and infrastructure, dealing with conflict, understanding compliance to social rules, and preparing institutions for change (Dietz et al 2003). The process of analytic deliberation is often central to facilitating the most productive dialog between interested parties, officials, and scientists, yet is rarely focused upon entire sectors at global scales.

I designed these conceptual models in knowledge management as the object of facilitated group discussions between tourism and climate change researchers, policy makers, industry members, tourism planners, and intra-governmental organization representatives at 6 international meetings (ESF 2003; NATO 2003; WTO 2003; ISB 2004; EIFIA 2004). Those that participated were members of those meetings (see individual references for complete lists of participants). The meetings revealed a chief concern among participants that frequently a polarization occurred among meeting participants - described by conceptual model 1 later in this article. Meeting participants felt that this division obscured complex underlying drivers of the system, and created barriers to sustainable tourism proposals which should otherwise receive more systemic support. My solution to this problem was to propose and facilitate a systems approach to the polarization referred to as the “two-way street” (model 1). In this way, practitioners could focus discussions on the “vicious circle” (model 2) relating tourism, its impacts, and climate change, break it down analytically according to scale, and revise it as the “virtuous circle” needed to support the transition to sustainable tourism. The circle format also provided a structure upon which to place and summarize literature, facilitate discussion, and identify goals for group knowledge management.

Section 2: Conceptual Models in Knowledge Management

The construction of the ‘State and Change’ conceptual map (Patterson 2003) was informed by developments in the areas of adaptive governance, adaptive management

(Deitz et. al. 2003), integrated assessment (Kasemir 1999, Rotmans and van Asselt 2001), and general systems theory (Meadows 1997; Forrester 1968; von Bertanffy 1968). The common link among these is they not only accept, but emphasize the differences in perspectives, interests, fundamental philosophies and test conditions as a means to spark learning and change. The evaluation of the conceptual models will be discussed in terms of two bodies of literature; successful *system transition* (Amelung et al. 2002; Martens and Rotmans 2002), and *tempos* i.e. the multiple paces of system change (Tiezzi 2004).

One of the principal challenges faced by an emerging research group is the formation, articulation, and use of shared conceptual models. Rarely scrutinized, this step of problem solving is critical to the process of study and design of public policy (Adams et al. 2003). A well formed conceptual model can assist a group in

- extracting tacit knowledge from network members;
- encapsulating shared knowledge and structuring consensus;
- facilitating productive discourse;
- identifying knowledge gaps;
- defining shared goals and strategies;
- informing others and extending knowledge applications.

Crucially, conceptual models play a critical role in challenging paradigms. A more concerted balance between analysis (breaking down a problem into its component parts and understanding how they function) and synthesis (the ability to put pieces

back together in a creative way to solve problems) is necessary to address difficult and complex linkages such as those which link tourism and climate change (Costanza 2003). Use of conceptual models can provide a platform for this innovation and re-thinking. An effectively designed conceptual model places the body of research in neutral ground, is inclusive to multiple perspectives, and can be used strategically to neutralize polarizing tendencies, or promote new collaborations (Tannen 1999 as cited by Costanza 2003). Here I present two such models which can be seen to shed light on sustainability issues related to tourism and climate change.

Section 3: Conceptual Model 1: a Two-way Street

The first conceptual map presents a sketch of how tourism climate change interactions look when broken down analytically as a directional, linear, assessment (Patterson 2003). Typically, tourism and climate change is considered as “a two way street”; climate influencing tourism, and tourism influencing climate (Figure 1).

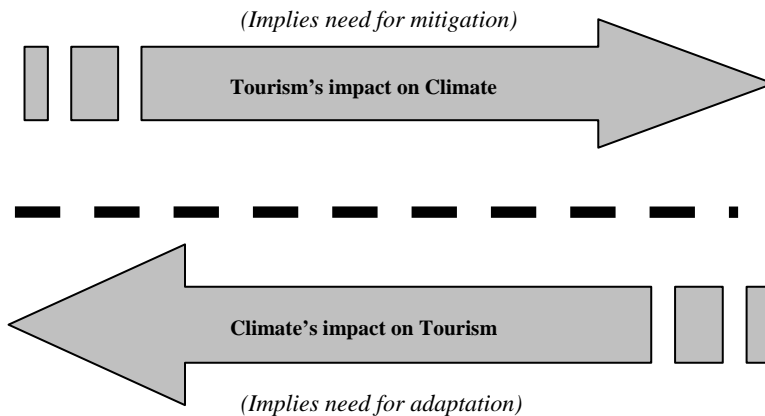


Figure 8.1 The tourism-climate change system is typically illustrated as a two-way street.

The top half of the diagram reflects the various ways in which tourism influences climate such as studies of energy consumption, emissions, etc. Tourism policy interventions therefore concern mitigation, attempting to reduce radiative forcing due to tourism. The lower half of the diagram represents conclusions about climate's influence on tourism, based on tourist arrival projections, behavioral and perceptual studies. Interventions thus identified are of an adaptive nature.

Studies embracing either position can be grouped according to categories (Table 8.1), but rarely address adaptation and mitigation simultaneously. While it is almost automatic for tourism researchers to divide the body of tourism/climate change interactions for this reason, this tendency poses significant problems for taking a systems approach to resolving stakeholder conflict.

Category	Examples
Destination types	Urban; Biome; Protected Areas; Community; Coastal; Mountain
Geographic regions	Transects; Regional comparisons; Continental
Tourism segments	Annual; Seasonal; Day-visitors; Short-haul; Long-haul
Environmental	Water; Landscapes; Extreme events; Vegetation; Hydro-cyclic; Physical Infrastructure; Historical Assets
Issues of Concern	Health; Vulnerable Areas; Ethics - Intra and Inter-generational Equity
Policy structures	Levies; Tradable Permits; Voluntary Agreements
Methodology	Theoretical; empirical; qualitative; quantitative
Models	Descriptive (numeric); prognostic (forecast); planning (optimization)

Table 8.1. Tourism and climate change research categorization. Studies which address adaptation rarely simultaneously address mitigation, and vice versa.

Namely, there are several discontinuities between “streets”, which are not likely to be resolved while dividing information in this way. When attention is focused on climate’s influence on tourism, adaptation is viewed as the appropriate response. When tourism’s influence on climate is the primary concern, discussions center on mitigation. Thus, when finances, time, or resources for problem solving are limited, adaptation and mitigation appear almost as mutually exclusive options. Concerns for economy and environment appear to be diametrically opposed. Under this conceptual model, win-win solutions are precluded; to advance in one direction means that less progress is made in another.

One example of an errant conclusion is that since mitigation success requires co-operation with other actors, the most risk averse solution appears to be to accept climate change and invest solely in adaptation. If the consequences of adopting either of the strategies were known to be equal, or if we knew with reasonable certainty the extent of their consequences, the disproportionate emphasis on adaptation would be more likely to bring about sustainable tourism solutions.

Conceptual model 1, places a great weight on “economic optimization” – the idea that you can select among system attributes and control system parameters, addressing risk and volatility with least cost. Because tourism is a powerful tool of development, and responds rapidly to economic changes, to many this imparts an illusion of control of the broader system. Yet as stated by Meadows (1997) the inherent unpredictability of complex systems means that as advanced as models, calculations and

measurements may be, this often leads to very general understanding. Goals to make the tourism-climate change system “behave”, by modifying system attributes (adaptation or mitigation interventions), are achievable objectives- yet real “control” of its evolution is achievable only in the short run.

Meadows pointed out optimization in the short run is very different than shaping our collective environment in the long run. The difference is in the extent and depth of collaboration among individuals who orient their efforts toward the problem at hand. To make this shift for tourism and climate change, new policy thinking and tools must first: support long-term non-territorial collaboration, second; incorporate adaptation and mitigation in ways which are not mutually exclusive, and third, address the following paradox: that the cross-section of the global population driving the demand for tourism resources threatened by climate change, are also disproportionately responsible for increased radiative forcing (Ceron and Dubois 2003; Patterson 2005). Model one does not draw adequate attention to these goals.

Another reason why model 1, albeit explicative, is not complex enough to encompass tourism and climate change interactions; is that the mechanisms which allow us to conceptually transition from one direction of the street (or social goal) to another are unclear (Patterson 2003). If policy choices are to include both adaptive and mitigative measures, the decision to reorient attention from one direction to another cannot be based in quantitative information. The result can often be subjective standards which may be more inclined to political forces than scientific principles or research.

An especially notable incongruity is that of temporal scale. Climate effects on tourism, (categorized as principally a business concern), have a time horizon of between three to five years. In contrast, tourism's impacts on climate change (principally categorized as an environmental concern) are expected over time periods of decades. This contrasts with the extremely short-time horizon for media awareness (in terms of a few days, and often associated with only extreme events). This is quite incompatible with the time horizon needed to raise awareness for instituting long-term policy and infrastructure changes. Issues of intra-generational equity issues thus present such long-run challenges as to be intractable when interests are posed in diametric opposition as in model 1.

A most prominent shortcoming with conceptual model 1 with respect to sustainability is that it fails to remind us that whether that of tourists or tourist policy makers, human activity constitutes an important element of the tourism - climate change system. It is not enough to weigh the costs and benefits of mitigation against those of adaptation. A new conceptual model is necessary.

One reason why this has not been accomplished to date is that even in conceptual problem-solving, it is perhaps easier to take a linear or directional approach to problem solving, despite that a systems approach would be a more complete characterization of system dynamics. That a systems approach may not be linear means that people frequently associate it with circular logic. Rigorous linear thinking

does not do well with the uncertainty and paradox systems approaches present (Rotmans and van Aaselt 2001). Counteracting this tendency requires gathering of inter-disciplinary scientists and policy makers, designing conceptual models and accounting for path dependence and a systems approach at multiple scales (i.e., how they are nested among various layers of the system) (Levin 1999; Low et al. 2003). The mix of causal and consequential factors within the same model relating climate change and human activity, while rare, is increasingly necessary to address sustainability challenges.

Section 4: Conceptual Model 2: States and Change

The design of the second model, aims to join, rather than divide the two perspectives offered by model 1; that of the tourist and tourism industry's effect on climate, and that of climate's impact on the tourism industry and destinations. Furthermore, it is designed to reflect that the tourism/climate system is dynamic, has multiple scales and elements to be considered, and that important system drivers underlying these dynamics are not discussed in current research. Advancing the state-of-the-art with respect to sustainability issues at the intersection of tourism/climate knowledge means referring separate factions of investigation to what is ostensibly a broader system (Figure 8.2).

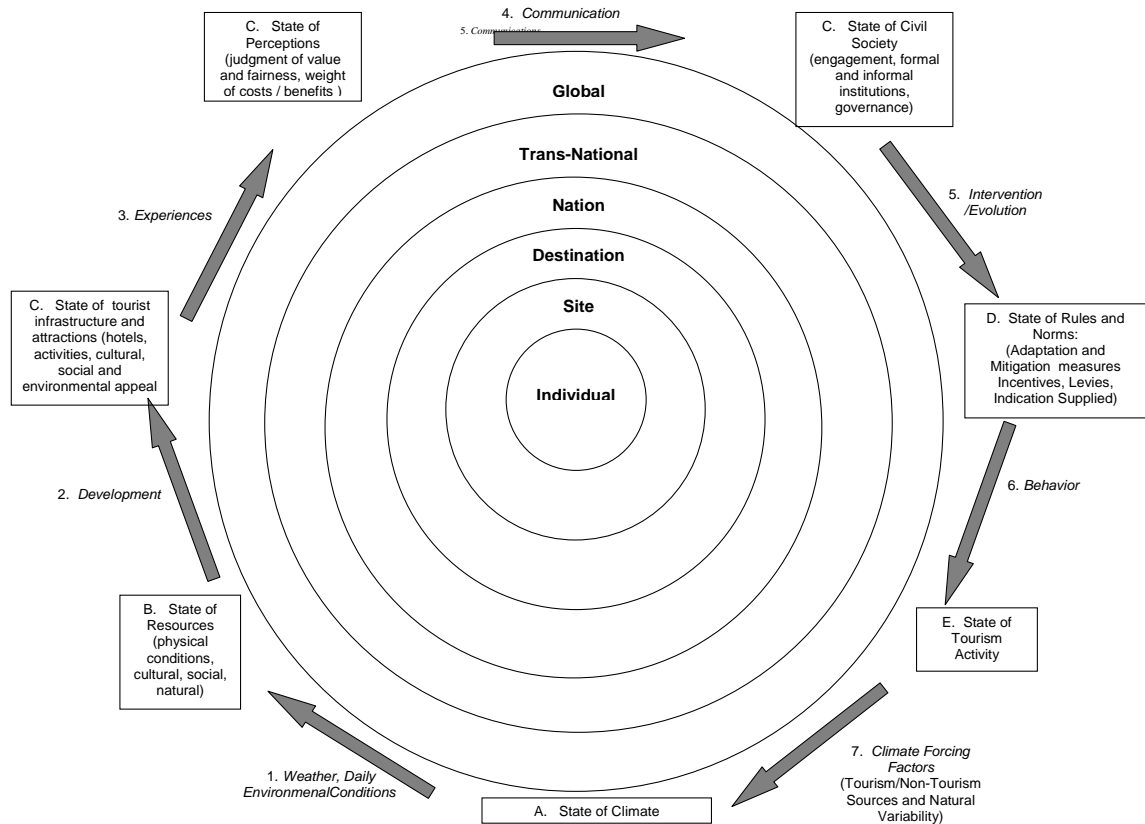


Figure 8.2. The tourism/climate system, modeled as a hierarchical complex adaptive system.

Rotmans et al (2003) define a *system transition* as a gradual, continuous process of structural change within a society or culture. Rather than being deterministic, transitions adapt, learn, and anticipate new paths through exposure to time. The ways in which intervention takes place in a system transition can influence the scale, speed and direction of it, but system control should be considered to be limited and temporary. *Tempo* (i.e. the multiple paces of system change (Tiezzi 2004) is relevant to two distinct dimensions of system transition as reflected in this diagram; first, multiple spatial scales as defined at a given moment in time and, second, multiple states through time-steps which are measured in a single space.

The first of these two considerations (the multiple spatial scales of investigation) are reflected by the concentric circles in Figure 8.2 (see also Table 8.2). The design of this model allows researchers or stakeholders to specify the applicable spatial scale of their work, awareness or concerns from individual to global measurement/application.

SCALE	
Individual	Autonomous concerns, perceptions, behavior and decisions
Site	Location such as beach, park, hospitality facility, hotel, etc.
Destination	A particular region or group of sites with homogenous marketing characteristics
National	National policy or actions
Trans-national	Policies which influence two or more nations
Global	Global commons as a whole

Table 8.2. Scale descriptions

Differentiating scales explicitly in this way, attention is drawn to the fact that among the scales in Table 8.2, time-steps are usually not congruent. Societal, economic, and ecological changes can occur at any range of time periods, from an immediate agreement among two cooperating individuals, to coordinated movements among individuals which take decades or more to emerge.

The second tempo relevant to system transition has to do with tracking information at a given site through multiple time-steps. The terms “stock” and “flow” in dynamic modeling are useful to understanding the relationship between ‘state’ and ‘change’. The boxes in Figure 8.2 represent “states”. These are the aspects of the tourism/climate change system that change relatively slowly over time. They can be

described in terms of quantity and quality. Between these stocks lie “changes”. The arrows in the diagram represent the flows which adjust relatively rapidly, and from which the relationships between the stocks can be discerned. Taking this perspective, research in tourism and climate change can be categorized as attempts to reveal the quantity or quality of these states, or the relationships of change among them.

Components of the diagram in boxes (marked with letters, below) refer to state changes. Characteristically, they are relatively easily measured with indicators, and are slower to change than the change functions (marked with numbers). Change functions refer to those systemic aspects more inclined to rapid changing, high variability and/or subjectivity. While one can think of many studies and issues which involve various pieces of the diagram, the direction-wise approach narrows the focus of tourism-climate change interactions while allowing for a wide variety of spatial scales, state functions and changes to be addressed.

Beginning with the bottom of the diagram, the first box refers to the (A) State of Climate. Next, (1) weather and daily environmental conditions encompass the variability and various environmental components which affect (B) the State of Resources (physical conditions, cultural, social, natural). Use and organization of these resources leads to (2) development which influences (C) the State of Tourist Infrastructure and Attractions (hotels, activities, cultural, social, and environmental appeal). These are what host community and tourist (3) experiences are based upon, and over time these determine (C) the State of Perceptions (judgment of value and

fairness, weight of costs / benefits). How these perceptions influence broader social outcomes depends upon (4) communication, and the overall (C) State of Civil Society (engagement, formal and informal institutions, governance). Next, the (5) interventions/ evolution which take place determine the (D) State of Rules and Norms: (Adaptation and Mitigation measures, Incentives, Levies, Indication Supplied). All of these influence (6) behavior, and have impact upon the (E) State of Tourism Activity. Tourism and non-tourism sources and natural variability are the (7) climate forcing factors which drive changes to the (A) State of Climate.

Systems theorists are interested particularly by actions which trigger others, thereby supporting changes “spiraling through a system” (Rotmans 2001), in other words, profound and prolonged shifts leading to new stable states. The “success” of a transition, according to Rotmans et al (2002), is one hallmarked by multiple causality and co-evolution of independent developments. How deeply policy changes are linked to and reinforced by predictable tendencies of economic, environmental, and social systems has much to do with how that change will persist through time, and at what extent. A complete description of system transition in the tourism/climate change system must address tempos of state and scale.

Section 5: Summary

Constructing, modifying, and using a conceptual model is a necessarily participative activity. In the acts of building up, tearing down, and rebuilding again, researchers become fluent in using the jargon, concepts, and tools of measurements necessary to

communicate across disciplines and case studies. Active, focused, and participative use of conceptual models can assist a research group in reaching its fullest potential. Because thoughts, actions, and policies crystallize around these conceptual models it is critical they reflect an adequate level of complexity and are inclusive- both of different perspectives and the range of relevant temporal and spatial scales.

This paper presented two such models which can be seen to shed light on sustainability issues related to tourism and climate change. Previous studies relating tourism and climate change have tended to adopt one of two perspectives; climate's influence on tourism, or tourism's influence on climate. Problem solving for complex global phenomena such as tourism and climate change requires collective examination of shared concepts and knowledge, drawing out various assumptions and causal links between areas of research interest, and identifying gaps in understanding.

When discussing the tempo of transition in tourism climate change systems, two themes are emphasized: first, addressing various spatial scales, and second using measured time-steps to explicitly examine the causal links between aspects of supply/demand and climate forcing/intervention. Knowledge about a system can be structural (it refers to the quantity or quality of something about the system that changes relatively slowly over time), or functional (meaning that it refers to relationships between elements of structure, ones which change relatively rapidly over time). These terms are similar to "fast change/slow change" or "stock/flow" descriptions found in dynamic modeling. The aspect of tempo of system transition is

in part reflected by separating out the 6 system states, from the 6 system changes.

This information is complimented by information about spatial scales, from individual to global extents.

The second conceptual model presented (Figure 8.2) is possibly a more appropriate framework within which to place recent research, particularly because it orients discussion of the problem solving community - away from the academic tendency to depict the most complex problems as polar opposites (Costanza 2003), away from an idea of short-term optimization (Meadows 1997), away from an idea that either adaptation or mitigation can be exclusively successful strategies. Creating conceptual space for a systems approach (both at temporal and spatial scales) is a first and necessary step toward research which addresses sustainability challenges linked to tourism and climate change. From there, conceptual models must support long-term non-territorial collaboration, incorporate adaptation and mitigation in ways which are not mutually exclusive, and lastly, address the following paradox: that the cross-section of the global population driving the demand for tourism resources threatened by climate change, are also disproportionately responsible for increased radiative forcing.

Chapter 9: Conclusions

*The mastery of the turn is the story of how aviation
became practical as a means of transportation.
It is the story of how the world became small.
William Langewiesche*

*“Because its better to die on one’s feet than live on one’s knees. I guess you’ve heard
that before.” “Yes I certainly have,” mused the treacherous old man “But I’m afraid
you have it backward. It is better to live on one’s feet than die on one’s knees.
That is the way the saying goes.”
-Joseph Heller, Catch-22*

The new millennium was born under the sign of the tourist. Tourism, especially alternative tourism, has been increasingly cited as a silver-bullet to development problems. An ecological economic approach however, recognizes that sustainable tourism can only be proposed as an allocative, rather than absolute solution. While these “alternative tourisms” give a common perception that like angels, this activity is infinitely squeezable, the reality is that this activity still requires some resources- which are finite. There is a sustainability limit to the growth of even “sustainable tourism”, and where that is depends on how decision-makers conceptualize their “realm of concern” and thus designate responsibility for tourism impacts at local to global scales.

An indicator useful at one scale can be inappropriate when employed at another- as is illustrated by the following vignette: a blind man was describing his favorite sport, parachuting. When asked how this was accomplished, he said that things were all

done for him: "I am placed in the door with my seeing eye dog and told when to jump. My hand is placed on my release ring for me and out I go with the dog." "But how do you know when you are going to land?" he was asked. "I have a very keen sense of smell, and I can smell the trees and grass when I am 300 feet from the ground" he answered. "But how do you know when to lift your legs for the final arrival on the ground?" he was again asked. He quickly answered: "Oh, the dog's leash goes slack." We can find irony in this story because obviously, there could be other more modern, reliable indicators the blind man could be using. We foresee him to be a tragic figure who has unknowingly taken unnecessary risk. Familiar indicators and what we can ascertain using our own senses seem to be dependable and assuring even when the activity involves risk. One case in point is global contributions to climate change. When only local indicators are employed by decision-makers to designate what are intended to be globally sustainable limits, the resulting assessment may prove to be incomplete.

Section 1: Review of Findings

This dissertation began with a series of questions raised by local concerns about tourism expansion in Val di Merse. An ecological economics perspective was taken to extend these to issues of relevance to global sustainability. The ecological footprint was applied to the two populations of tourists and residents. It was found that in contrast to prior studies of mass tourism sites and beach resorts, rural tourists in Val di Merse consume and produce waste locally at similar levels to residents (5.4 gha/tourist equivalent vs. 5.5 gha/resident). These levels were also lower than the

weighted average of ecological footprints from tourist's countries of origin (6.7 gha). While the ecological footprint can only be considered as a model of consumption, and cannot be presented as any test of statistical difference, one possibility is that tourists on average consume less on vacation than they do at home. A much more specific and controlled study of tourists at home and on vacation and the factors that influence their consumption is one promising avenue for future research.

Chapter 5 also gave some environmental explanation for the low tourist environmental footprints, such as Tuscany's relative absence of climatic extremes. Other factors were infrastructure which reduced energy use- be it conservative cultural habits, traditional efficient architecture, and information readily available to tourists. Locally made product offerings, daily tourist activities of low energy impact, and a strong local cultural strength are other reasons why Val di Merse tourism impact has a small ecological footprint with respect to other destinations in Europe and beyond.

At its current level of visitation, net local ecological footprints of tourist and resident populations (7.1×10^4 gha) can be compared to biocapacity (9.4×10^4 gha). This resource use and waste production can be considered to be within the bounds of sustainability as defined by the stocks of Val di Merse's natural capital. However, the picture of tourism impact changes radically once we begin to include those of airline travel. At 33 gha per tourist equivalent resident annually, arrival transport provides 86% of the environmental pressure (38 gha total) due to tourism. This finding

reconfirms conclusions drawn from studies of “mass tourism” destinations, yet is striking when one considers that the primary motivation for arrival to Val di Merse is “agrotourism”- otherwise known as a form of ecotourism. When the global impact of tourism to Val di Merse is included in ecological footprint estimates, the EF of residents and equivalent inhabitants rises to 1.0×10^5 gha. From this perspective, the net human presence in Val di Merse is already exerting environmental pressure in excess of the area’s biocapacity.

One goal of chapter 6 was to be able to compare the *ecological efficiency* of tourism from source countries to the revenues generated by visitors from those countries. This created a basis for comparison for rural tourism to compare to other industries in Val di Merse, and Val di Merse vs. other tourism destinations. Carbon dioxide equivalent (CO₂-e) emissions were used as a proxy for environmental damage on the global environment. As a proxy for value generation, Euro turnover was used, and included only primary spending, and did not use the tourism multiplier in secondary spending. The weighted carbon dioxide-equivalent emissions (CO₂-e) from arrival transport and accommodation (see Figure 6.6) revealed that the largest GHG contributors are visitors from the United States, Germany, Italy, the Netherlands, and Great Britain.

Comparing these figures with local tourism revenues, a typical Val di Merse tourist spends €72 per day, distributed among various use categories. Eco-efficiency was found to range between 0.4 kg CO₂-e per Euro for Italian visitors, to 4.0 kg CO₂ -e per Euro for Australians and New Zealanders (higher CO₂ figures being less

desirable). When all accommodation emissions and arrival transport revenues were included, the value was 0.85 kg CO₂-e per Euro, a figure which is lower (more eco-efficient) than all other known European cases. In combination with the findings in chapter 5 of low consumption, much of the eco-efficiency of Val di Merse including arrival travel must be attributed to the rather low share (10 percent) of non-Europeans visiting the area.

To put the tradeoffs this presents for Val di Merse tourism (in comparison with other sectors) in context, the GHG balance for Chiusdino was presented. If Chiusdino were to take full responsibility for the airline emissions from those visitors, the result would comprise over one-quarter of total GHG impact of the commune. However, these results need be considered within the context of complex local and global realities. In local terms, Chiusdino is a net carbon sink, and tourism plays a part in supporting a diversified economy. At a global level, tourism may be considered a means, rather than ends to becoming more sustainable. In some parts of the world, even international tourism can still be an ecoefficiency bargain, offering substantial improvements (eg. over particularly wasteful industries such as Amazon logging-burning Brazilian rainforest for pastures has an ecoefficiency of 4,878 kilograms CO₂-e per Euro) (Portella 2004, personal communication).

To remain within the levels indicated by Val di Merse's biocapacity assessments, alternative tourism can only be proposed as an allocative, rather than absolute solution. One policy option suggested was to promote more tourism from local

countries or within Italy (i.e., orienting promotion around nearby countries vs. Japan or the U.S.), or provide incentives for longer stays, or local products low in ghg production (ie. wine). If it were possible that sustainable tourism activity of the future could teach visitors long-term lifestyle changes to reducing their consumption and waste production- this would be a meaningful step toward the ecological economic goal of reducing economic throughput for a sustainable future.

Chapter 7 explained that sustainable tourism initiatives often rely on a form of social carrying capacity, or the ability to locally perceive a decline in environmental quality. Climate change and the emissions that contribute to it are one example of tourism activity affecting public goods. This chapter then discussed the growing impact of airline emissions, and the lack of social institutions to deal with it as a global public goods problem. Appreciating the differences between global and local sustainability depends on one's vantage point. From a bottom-up understanding (local-to-global) tourism impacts may exist at the global level, even when they are not accounted for at the local scale. An ecological economics perspective of sustainable tourism takes a top-down approach (global-to-local) to assessing impacts, advocating that all externalities must be accounted for at some local level. *Without global sustainability, there can be no local sustainability.*

While the earlier chapters made use of a quantified measure of sustainability, it is clear that use of an indicator is not sufficient. The "realm of concern" of a policy maker, both in spatial and temporal distance, is important to making explicit and

attainable goals for sustainability. Chapter 8 illustrated some of the conceptual difficulties in knowledge management, showing how polarization among those concerned with the issue of tourism and climate change obscures the importance placed on defining for whom and what sustainability is intended, and for how long.

Locally sustainable tourism has been defined for the purposes of this study as local tourism activity which does not drive the local system to overshoot its biocapacity; through direct consumption/waste production by its inhabitants or tourists, or through indirect pressures such as impacts that occur at spatial or temporal distance from the place of consumption. To be truly sustainable, tourism must maintain or increase net social benefit for future generations. Natural capital contributes to net social benefit via market and non-market contributions. Broad-scale environmental changes (e.g. climate and landscape level effects) influence natural capital. Contemporary tourism produces large amounts of airplane emissions. Airplane emissions are significant contributors to the key driving variables of climate change, and climate change produces sub-critical, but pervasive environmental stress. Assessments of tourism carrying capacity based on local-level effects fail to account for airplane emissions, or the use of “hinterlands” to support high levels of resource and energy consumption. Thus, even if accounted as sustainable at the local level, alternative tourism can also drive environmental impacts which would otherwise be considered unsustainable at the global level. Despite what is indicated by the local environment and the indicators used to assess it: without global sustainability there can be no local sustainability.

Tourism to Val di Merse and other rural areas of Siena have a less intense environmental impact because most are small-scale family-run entities who govern utility use and food economy with traditional home-economics. Yet both tourism and climate change are complex global phenomena. In searching for limits to sustainable tourism, researchers frequently focus on direct impacts from tourism as obvious, quantifiable changes which *necessarily* cause a destination to lose its ability to provide the goods and services (both natural and social) which support the host community and tourists alike. Yet non-direct system impacts of world-wide tourism can be *sufficient* for a destination to lose its ability to provide a continuous stream of goods and services.

Limitations of this research are that ecological footprint studies require a great deal of generalization, and are limited by the data available. Ecological footprints are more appropriately viewed as a model of consumption- than any valid statistical comparison between populations. Another limitation in data collection is the difficulty of collecting data from tourists, of different motivations, different vacation lengths, itineraries, and communication languages. The data collected here was done in 5 native languages of the visitors. This is would be more challenging for destinations which appeal to a broader range of nationalities (e.g., international tourism from Japan and China are both rising in popularity). Moreover, data availability to perform accurate EF calculations for tourists could be a special challenge in countries where data are sparse, or tourist activities and habits are not as homogenous as Val di Merse.

There are many interesting directions for future research. The scoping study of Val di Merse presented here (Chapter 4) was narrative and qualitative, but many of these observations could be quantified by geographers or landscape ecologists. The ecological footprint is not complete as a sustainability indicator, and cannot be used as such. It must be accompanied by a complete description of the social, cultural, and economic environments (at local and wider levels).

I began the dissertation with a discussion of flying entities, it seems appropriate that I conclude it with one. For many, the story of how aviation became a practical means of transportation is the story of how the world became small. This dissertation dedicated much space to rising trends in airline emissions, in part to call attention to the role of air travel's increasing role in human impact on the planet. I have focused on some issues viewed by other tourism analysts as latent, and which have thus received little attention. Issues are sometimes viewed as 'too complex' because they are embedded in economic and social structures which uphold elite interests, manifest in marginalized locales or populations, or because any additional attention is seen to challenge existing cultural, political, and economic arrangements. Upon the near collapse of the post-Kyoto meeting in Buenos Aires last December, EU head delegate Dutch environment secretary Pieter van Geel summarized, stating: "A lot of people are afraid of discussing the future." His words referred to the failure of the meeting's intentions to determine worldwide cooperation to reduce global warming following

the first 15 Kyoto years to 2012, a meeting which also had proposed to include accounting of airline emissions in GHG protocol.

For the phrase ‘sustainable tourism’ to have meaning for all of the relevant stakeholders (ie everyone affected, worldwide), it must be sustainable at local to global scales. At a local level this means conservation of institutions and social mechanisms that take special account of aspects of natural, cultural, and economic patrimony that might otherwise be lost in efforts to develop the country’s tourist industry. Further, economic throughput must be maintained at a scale which can be supported (in terms of efficiency and justice) in the short term, and which is generally consistent with social conceptions of perpetuity. At a global level, this implies that problems with global public goods are being made apparent and entering into global discourse, that critical questions are being asked of where the limits of concern for others exist, and that efforts are being made to continually widen this boundary – embracing both marginalized stakeholders and future generations. Without understanding globally sustainable tourism, there can be no locally sustainable tourism.

There are fundamental differences between those who (to use Heller’s terms) define the worth of man’s earthly struggle by life or death on one’s feet or knees. Refusal to recognize this underlying subjectivity results in a tendency to dismiss paradox which results. Its possible that a fundamental blockage to humanity’s progress is that we fear we are neither rationally nor emotionally equipped to deal with reconciliation of so

many variables. While we may make progress toward individual objectives, at some level there also appears we have a protective sense for that which registers as sublime. Conscious and shared examination of these situations must be attempted, because the greatest risk is to risk nothing. Chained by certitude, we forfeit the degrees of freedom necessary to escaping “the catch” of present reality, and our right to active and creative roles in the future we are now creating. As Heller wrote, “The spirit gone, man is garbage... Ripeness was all.” Only the person who risks is free.

Appendices

Appendix 1. List of questions used in interview of tourists

I am collecting information for a tourist survey of Val di Merse tourists for the University and Province of Siena, do you have time to answer a few questions?

- 1) What is your age?
- 2) What country are you from?
- 3) Are you married?
- 4) Do you have children? How many?
- 5) How many people are in your group today?
- 6) How long is your vacation?
- 7) By what travel method did you arrive to San Galgano/Val di Merse? How many nights will you spend here?
- 8) By what travel method did you arrive to Province of Siena? How many nights will you spend here?
- 9) By what travel method did you arrive to Italy? How many nights will you spend here?
- 10) What distance do you drive on a daily basis?
- 11) Can you show me on the map all the places in Val di Merse you have visited or plan to visit?
- 12) Can you show me where you are staying?
- 13) What kind of structure is it, a hotel, an agrotourism, a rental apartment, or a friend's house?
- 14) I need to categorize where you eat your meals: for breakfast, lunch and dinner do you eat for the most part at your place of lodging, a bar, a restaurant, or from what you've bought at the grocery store?
- 15) Have you purchased, or plan to purchase anything on your trip? What?
- 16) Have you participated in any of the following activities: hiking, horseback riding, shopping, winery or farm visits, museum visits? Any other activities?

Appendix 2. EF of a Chiusdino resident (Val di Merse proxy),

ha eq / per capita annually	EF energy terrain	EF agriculture terrain	EF pasture terrain	EF forest terrain	EF degraded terrain	EF sea territory	EF total (ha eq)
Food	0.61	0.55	0.69	-	-	0.27	2.13
Housing	0.64	-	*	0.02	0.03	-	0.69
Transport	1.26	-	-		0.05	-	1.32
Other Goods	0.26	0.02	0.02	0.11	0.01	-	0.43
Services	0.43	*	*	*	0.02	-	0.46
Refuse	0.23	-	-	0.19	0.03	-	0.45
Total	3.43	0.57	0.71	0.33	0.14	0.27	5.47

“-“ = n/a, “*” < .01, The standard ecological footprint practice is to reporting to two decimal places.

Appendix 3. The ecological footprint of a tourist (equivalent inhabitant) including arrival transport

	energy terrain	agricultural terrain	pasture terrain	forest	degraded surface	Sea	total
arrival transport	32.79	-	-	-		-	32.79
food consumption	0.64	0.57	0.72	-	-	0.29	2.22
electricity consumption	0.40	-	-	-	-	-	0.40
heating fuel	0.47	-	-	-	-	-	0.47
water consumption	-	-	0.03	-	-	-	0.03
land use	0.19	-	-	-	0.04	-	0.23
Waste	0.23	-	-	0.19	0.04	-	0.45
Activity	1.57	*	*	*	-	-	1.57
TOTAL	36.28	0.57	0.75	0.19	0.08	0.29	38.15

Sources: Data for land courtesy (ISTAT 1991), food(ISTAT 1999), combustibles (GRN 1999) water(ISTAT 1999), consumer prices (ISTAT 2002). “-“ = n/a, “*” < .01, Standard ecological footprint practice is to report out to two decimal places.

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