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HOW CAN TOURISM RESEARCH BENEFIT FROM MULTI-DISCIPLINARY ASSESSMENTS OF CLIMATE CHANGE? LESSONS FROM THE U.S. SOUTHWEST

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ABSTRACT This study reports on Climate Assessment Project for the Southwest (CLIMAS) research on climate and nature-based tourism and recreation. Three case studies – of the ski industry, national park recreation, and wildfire management – illustrate different ways of using climate data for tourism research.

KEYWORDS*:* U.S. *Southwest, skiing, national parks, water-based recreation, fire management*

INTRODUCTION

The U.S. Southwest has spectacular landscapes, warm sunny weather, and diverse recreation and tourism opportunities. But the region also faces high seasonal, inter-annual, and decadal climate variability and high forest fire risk. Droughts, heat waves, severe frost, and floods are among other serious, climate-related threats. Recent projections suggest that substantial climate change is likely to occur, posing additional risks. Hoerling and Eischeid (2007) project that, for the Southwest, "a near perpetual state of drought will materialize in the coming decades as a consequence of increasing temperature (p. 19)." Other climate change models predict declining snowpack, shorter and more variable snow seasons, warmer winter temperatures leading to less snowpack and more sublimation, earlier spring snowmelt, and a rise in the elevation at which snowpack can be maintained (Mote et al., 2005, Diffenbaugh et al., 2005, Knowles et al., 2006).

CLIMAS was established in 1998 with funding from the National Oceanic and Atmospheric Administration to assess impacts of climate variability and longer-term climate change on human and natural systems in the US Southwest and Mexican border area, and to improve the region's capacity to respond to climatic events and longer-term change. Research on the outdoor recreation and tourism sectors across the US and especially in the Southwest indicate a marked vulnerability to climate variability and change (Arizona Governor's Drought Task

Force, 2004, New Mexico Drought Task Force, 2004). The implications are large, for the U.S Department of Agriculture categorizes many non-metro Southwest counties as "recreation counties" – counties economically dependent on recreation, tourism and seasonal housing (Fig. 1) (Johnson and Beale, 2002, Reeder and Brown, 2005).

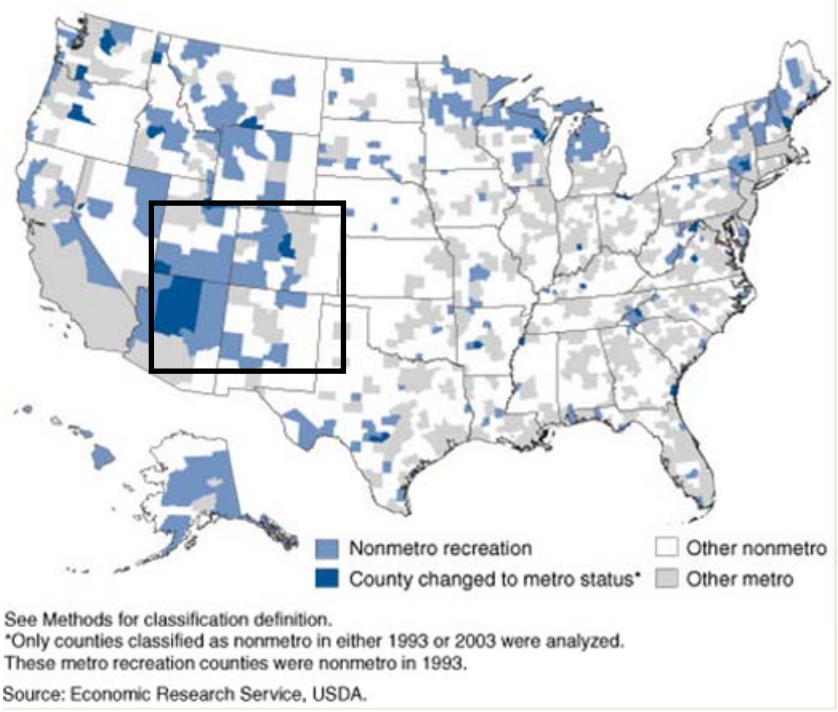

Figure 1: Non-metro recreation counties are clustered in the Southwest

At the national level, seasonal housing - recreation rentals and second homes - has expanded rapidly. From 1965 to 1990 U.S. housing units doubled, while second homes rose from 4 % to 5.5 % of the total. By 2000, 6.5 % of Arizona housing units were second homes (Smith, 2007). Typically second homes provide access to environmental amenities unavailable at the place of primary residence and tend to stimulate greater local demand for goods and services than generated by other visiting recreationists and tourists. Many seasonal home owners plan to retire to their second home (Stewart and Stynes, 1993, Stynes et al., 1997).

Arizona is not typically considered a ski destination, but two medium-sized, high elevation ski resorts operate in the state. These resorts cater mostly to local skiers. The resorts generate local jobs, spending, and tax revenues. These economic benefits are important to the tribal-run Sunrise Park Resort and surrounding communities in the rural White Mountains region (Gibson and Evans, 2002) The other resort, the Arizona Snowbowl, is located near a ready market, Flagstaff, the state's third largest metropolitan area. The snow reliability at both resorts is variable and is influenced by the phase of the El Niño-Southern Oscillation (ENSO): La Niña winter seasons are typically dry in Arizona while El Niño winter seasons typically

portend a good ski season. In response to this variability Sunrise has invested in snowmaking capacity that covers ten percent of its runs and Snowbowl's management have attempted to pass a plan (against tribal and environmental objections) to provide the resort with effluent-based snowmaking capacity for all runs. This extensive plan and Sunrise's own plans to increase snowmaking capacity are signs that Arizona's resort managers are not only investing in snowmaking as an adaptation to inter-annual variability but also to longer-term climate change. Without such adaptation skiing is likely to become marginal in Arizona, resulting in economic hardship for winter-recreation dependent communities and tribes.

In concert with expansion of residential and recreational facilities, forest fire incidence has increased in the region. Research confirms a strong link between climatic patterns and interannual variability in forest fire activity. Added to climate-fire interactions are risks posed by heavy build-up of fuel loads from decades of proactive fire exclusion and recent drought, and by growth in second homes and other facilities (Allen et al., 2002, Westerling et al., 2006). A federal assessment of communities bordering federal lands and at risk from wildland fire listed 182 communities in Arizona and New Mexico alone (U.S. Federal Agencies, 2001). From 2000–2004 alone, there were 46 fires of >100,000 acres, three of which caused considerable damage in Arizona and New Mexico (National Interagency Fire Center, 2007).

METHODS

An econometric model of annual Southwest national park visitation was estimated with data for 42 parks from 1979-2003 to examine how climate-related variables affect visits. A fixed-effects model was estimated accounting for autocorrelation and using panel corrected standard errors (Gibson and Evans, 2002). Control variables included state population, gasoline prices, an exchange rate index, park age, extended road closures, and changes in visitation measurement protocols. Climate-related variables included levels of Lakes Mead and Powell, a park's July heat index (Beck, 1995), and a variable indicating if a park was in a climate division with a January–December 12-month Standardized Precipitation Index (SPI) $\leq$ -2. An SPI of -2 indicates a year with precipitation two standard deviations below average and is generally categorized as "extreme drought." A dummy variable also accounted for the Cerro Grande fire. Reductions in visits were then entered into the Money Generator Model II, an input-output model developed for the U.S. National Park Service to estimate impacts of visitor spending on local economies (Steadman, 1979). Water-based recreation at Lake Mead National Recreation Area (NRA) and Glen Canyon NRA accounts for a large share of

regional park visitor spending. Combined visitor spending at the two NRAs was $385 million in 2005 compared to $391 million in spending at Grand Canyon National Park (Stynes et al., 2002).

For the ski study, an econometric model of season visits at both resorts was estimated with data from 25 ski seasons (1981/82-2005/06) to examine how ENSO phase affects visits. A statistical test determined that data from the two resorts should not be pooled indicating that the resorts are different, perhaps in part because only Sunrise has snowmaking adaptation. The results of two separate regressions suggest that the El Niño phase is a positive and significant determinant of visits at Snowbowl but not at Sunrise. Snowbowl is more reliant on good natural snow conditions than Sunrise and might therefore benefit from snowmaking adaptation (Bark-Hodgins and Colby, 2007). However, snowmaking is not without its challenges: (1) it is expensive; (2) above -5°C snowmaking is technically difficult (Scott et al., 2003); and (3) it requires large volumes of water. Climate change is likely to shorten the ski season in Arizona because as temperatures rise more precipitation will fall as rain, the number of days in which it is technically feasible to make snow will decline, and more frequent heat waves (Diffenbaugh et al., 2005) could collapse snowpack. For the water-strapped Snowbowl it might be impossible to rebuild snowpack, which would reduce the season's skiable days and the resort's economic viability. In fact forecast temperature data for Arizona's Climate Division 2, where the resorts are located, indicates significant warming over the next century. By adding this warming to historic resort temperature data it seems likely that by 2030 April skiing will be marginal and by 2099 ski seasons will be restricted to December-February (Bark-Hodgins and Colby, 2007).

Research on the use of climate information for managing fire risk in southwestern forests centered on a series of annual fire-climate workshops, beginning in 2000. Participants invited to the annual conferences included fire climatologists and meteorologists, fuels managers, fire managers, and fire ecologists. To generate a broad understanding of fire issues, some of the workshops included members of the Joint Fire Science Board, fire social scientists, representatives of the Mexican fire fighting establishment and other experts. Each workshop featured presentations by climatologists, fire managers, and other experts, followed by development of a fire-climate forecast for the upcoming fire season. Over the past seven years, the workshops have evolved into annual meetings held under the auspices of the Predictive Services Office of the National Interagency Fire Center (PSO, NIFC), in collaboration with CLIMAS and the Desert Research Institute's Center for Ecological and Fire Applications. At these meetings, fuels managers and fire managers representing each region of the U.S., in consultation with climatologists, develop climate-fire outlooks for their specific

area. A national climate-fire forecast is also developed (Fig. 2). A proceedings document is published for each workshop and made available on the Web (Morehouse, 2000, Garfin and Morehouse, 2001, 2002, Garfin et al., 2003, Crawford et al., 2006). Given that recreation is the primary use of many of the nation's forests, these forecasts provide information useful for assessing levels of risk associated with recreational use, and potentially for anticipating fire outbreaks from human causes, such as untended campfires and improper disposal of cigarettes.

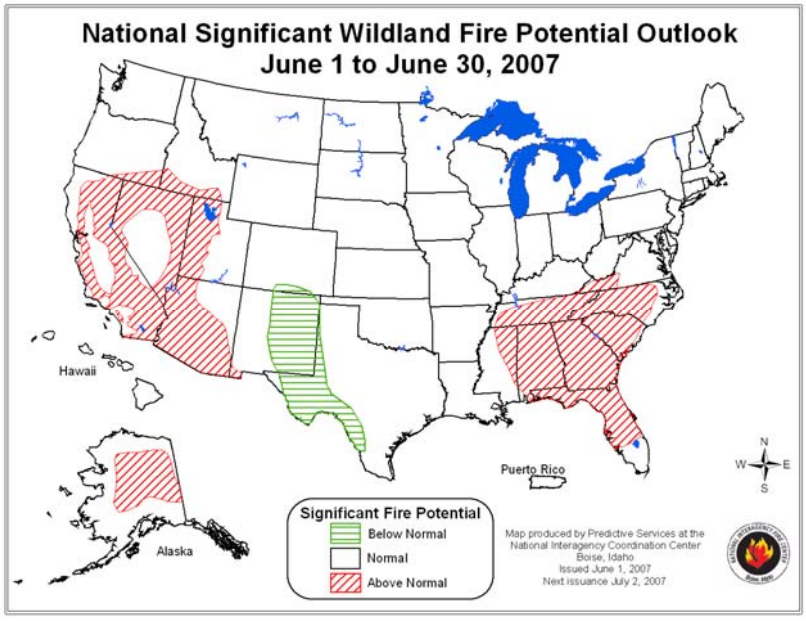

Figure 2: June 2007 Wildfire Outlook
Source: PSO, NIFC.

RESULTS

For the National Parks model variables capturing effects of fire and drought were statistically significant. A year of extreme drought (SPI $\leq$ -2) reduced visits by 7 % while the Cerro Grande fire in New Mexico reduced visits to Bandelier National Monument by 21 %. From 1999-2003 lake levels at Lake Mead fell 2.1 %, while Lake Powell levels fell 5.4 %. Based on regression results, the drop in lake levels from 1993 to 2003 contributed to a fall of more than 0.5 million visits to Glen Canyon NRA in 2003, with a loss of 758 jobs, $ 32.1 million in visitor spending $ 13.4 million in personal income. For Lake Mead NRA, lower lake levels contributed to 0.9 million fewer visits, 680 lost jobs, with a $ 28.1 million loss in visitor spending and a $ 9.6 million loss in personal income.

Climate change will likely reduce ski season length in Arizona. This is a concern because the ski industry is capital intensive and therefore each skiable day lost changes the financial

viability of the resort. It is also not clear that Arizona's skiers will continue to ski in large numbers at local resorts if only man-made snow is available. More snow reliable substitute resorts in Colorado and Utah may benefit whilst local economic impacts in Arizona could be severe unless local communities can adapt by making the most of every good natural snow season and developing non-winter recreation activities.

Loss of forest resources, and the economic and social benefits they provide, poses serious threats to rural economies. This is nowhere more evident than in Arizona, a state that receives substantial economic revenue from recreational and tourism activities. Fire-climate forecasts are proving to be a valuable tool to assess seasonal risk for managing recreational uses of U.S. forests and for managing the forest resources themselves.

DISCUSSION

The results highlight some challenges and opportunities for researchers studying climate-tourism-recreation relationships. Economics has important contributions to make, but measuring impacts of climate variability requires reliable time series data and reconciliation of data collected by different agencies, for different purposes, and at different temporal and spatial scales. Availability of good climate information and forecasts, as well as about the interactions among climate, environment, and society is also essential. Further, economists need help from other disciplines to specify explanatory variables in multivariate statistical models and to interpret results. There are well-developed econometric methods to deal with data problems and complex error structures in multivariate models. Panel data analysis, following observations across time and comparing them across space, provides greater power to determine causation from climate change to changes in tourism and recreation. Economics also has tools to estimate how physical and environmental changes translate into micro-level economic responses. These responses can be measured as monetary impacts that can be aggregated up to local, state or national impacts to inform public policy.

Assessing climate-fire-society relationships requires close collaboration among climatologists, meteorologists, fire ecologists, and social scientists. It also requires development of good working relationships with fire managers, fuels experts, decision makers, and policy experts. The workshop process for producing annual climate-fire forecasts at regional and national scales, is an example of how such collaboration can be fostered and sustained over time. These workshops led to a noticeable increase in awareness about climate impacts on wildland fire regimes, and by extension, on risks associated with recreational and other uses of forested areas. Climate change is likely to lead to increased fire hazard,

particularly in southwestern forests. Further, some burned over-areas are not likely to regenerate as the same kinds of forests; instead, species adapted to hotter and drier conditions such as those predominant at lower elevations are likely to emerge. As climate change unfolds, reasonably skillful fire-climate forecasts and ancillary fire ecology knowledge will become increasingly essential not only managing forest fire and its social impacts, but also for anticipating the likely economic and social impacts on valuable economic sectors such as recreation and tourism. .

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THE RELATIONSHIP BETWEEN TOURISM AND CLIMATE FROM A SUSTAINABILITY SCIENCE PERSPECTIVE – TOWARDS A CONCEPTUAL FRAMEWORK FOR RESEARCH ON THE FUTURE OF TOURISM

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ABSTRACT This paper deals with the problems of the tourism industry and tourism-related research in developing adaptive responses to climate change. A brief description of a typical situation for tourism development introduces the perspective of sustainability science with regards to climate, recreation and tourism. An outline of the reaction of the tourism industry and tourism-related research to global warming and its consequences leads on to a revision in the semantics of research on climate and tourism. In the final section, the paper offers a tentative conceptual framework for research on the co-evolution of climate and tourism.

KEYWORDS *Sociology, conceptual framework, sustainability, co-evolution, adaptation*

INTRODUCTION

Arco is a small, beautiful town in the province of Trento, in the north of Italy. On a hill very close to its centre, a medieval castle dominates the landscape, offering a scenic view of Torbole and Riva del Garda. The two neighbouring towns lie on the northern coast of Lake Garda. Lake Garda has a long tradition as a tourist destination. The ancient Romans already prized the climate and landscape of this region, but for a long time the townspeople of Northern Italy had sought recreation in the Southern seaside villages only. However, when wind surfing emerged as a new sports activity during the 1960s, the northern towns were able to catch up. Since especially the northern part of the lake is regularly exposed to powerful winds, Torbole and Riva del Garda have become hot spots for wind surfing. These communities experienced considerable development, while Arco, located about 5 km north of the lake, lay a short way off the old and new tourist tracks and remained an insider's tip. Witnessing this, the people of Arco became somewhat envious of their neighbours' good

fortune. Arco stayed the small town it had been, with its traditional social structure, surrounded by vines, citrus fruits and olive trees on the one side, and sheer limestone cliffs jutting up like a wall on the other. The only tourists to visit the area were a few rock climbers. They drove straight to the bottom of the rocks and camped in the olive groves without bringing much money into the town.

The situation has changed in the last few years (Bitala, 2007). Today, every weekend thousands of tourists flock to Arco. Since indoor climbing became popular in Germany five to ten years ago, Arco has been invaded by so-called "comfy climbers". Comfy climbers are not obsessed solely with the rocks they climb; they attend to their creature comforts at the same time as making their first moves on real rock. They are often accompanied by mountain bikers, who also like to take advantage of the Mediterranean flair and food following their activities. Businesspeople in the town obviously benefit from this development, as does the community in general. However, the traditional social structure is changing. Today there is no bakery, no butcher and no convenience store in Arco. The people of Arco have to do their shopping in a shopping centre near Riva del Garda.

The growth of tourism in Arco is also transforming the natural systems. Climbers are dependent on motor transport to reach the routes. Thousands of cars and motorcycles transport mostly German climbers over the Brenner Pass to Arco. It takes less than four hours to travel from Munich to Lake Garda. Like all the other Alpine regions with passes or tunnels, the region surrounding the Brenner Pass is severely affected by traffic and its emissions. Road traffic clearly tops heating and industrial facilities as a source of emissions including nitrogen oxides, particulate matter and carbon monoxide (Siegrist and Thudium, 2007).

How can Arco's growing economy be reconciled with the needs and aspirations of its population and with nature? This is the question at the core of a sustainability science perspective. Starting with this question, this paper concludes with an outline of a conceptual framework for research on the relationship between tourism and climate. It may initially seem confusing that this framework is not the inductive result of the concrete research findings of a climatologist. However, since travelling, organising and selling travel, and doing research on the consequences of travelling are all actions, it might be instructive to consider this issue from the perspective of general action theory. Such rare approaches in the social sciences, which study action as a coevolving system within an environment consisting of other, natural systems, could provide a suitable background for any further explorations of this interdisciplinary field (Parsons, 1978, Law and Hassard, 1978, Urry, 2003, Latour, 2005).

In this paper I present an argument for the relevance of sociological knowledge for understanding the relationship between tourism and climate. In the first section I present a critical overview of recent adaptive responses of the tourism industry (and tourism-related research) to climate change. After analysing this data I conclude section 2 with the proposal that we need a new tool for analysing the relationship between tourism and climate. I suggest solving the theoretical deficiencies of the concept of adaptation by employing the notion of co-evolution. On the basis of these considerations I outline my ideas concerning a conceptual framework for research on the relationship between climate and tourism (or – from a broader perspective – on the relationship between nature and society) in section 3.

DATA: ADAPTIVE RESPONSES OF THE TOURISM INDUSTRY AND TOURISM RELATED RESEARCH TO CLIMATE CHANGE – A BRIEF OVERVIEW

The tourism industry seems to be ambivalent about adaptation to climate change. A survey of tourism experts at the international tourism trade fair ITB Berlin in 2007 shows that the tourism sector is aware of the challenge posed by climate change. Around 90 % of the interviewees believe that tourism will be affected by climate change. Yet there are few constructive ideas as to what could be done about it. When asked about responses to climate change, 34 % have no answer, and 56 % did not respond when asked if they had already developed adaptive strategies in their own area of business (Lund-Durlacher et al., 2007).

Perhaps the tourism industry is ambivalent about adaptation to climate change, because the question of adapting tourism to climate change is ambivalent in itself. On the one hand, it is evident that the tourism industry today plays a leading role in the international economy. With 25 per cent growth in the past 10 years (UNEP and WTO, 2005), it is one of the largest industries in the world, and provides, furthermore, enormous revenues. Since there are few countries that do not function as a significant source and destination of tourism, the tourism industry pledges income for every region, even in developing countries.

On the other hand, it is also evident that the tourism industry does not make any indispensable contribution to humanity's survival. Hence, in the light of the man-made problem of climate change the tourist industry comes under increased pressure to account for its ecological consequences. Several studies have pointed out that tourism is a source of negative ecological impact (Buttler, 1991, Gössling, 1999, 2000, Gössling et al., 2003, 2005, Neto, 2003, Shah et al., 2002, Welford et al., 1999). Tourism accounts for approximately 5 per cent of the total CO_2 emissions (Davos Declaration, 2007). Especially air travel is detrimental to the global

climate, since planes emit mostly in strata of the atmosphere most vulnerable to pollution (Gössling, 2000).

Research on the tourism industry's ecological effects has been a marginal issue for a long time. This is especially true for climate impact research. The relationship between tourism and climate change did not become an issue of concern to the international community until 2003, when it was addressed at the "First International Conference on Climate Change and Tourism" on Djerba in Tunesia. The discussion triggered at this conference has since focused on adapting international tourism to the possible consequences of climate change (WTO, 2007).

Research on adaptive strategies in tourism has focused on maintaining economic structures. Some studies are concerned with adaptation strategies of different countries or regions, for example, Fiji, the Caribbean and the Mediterranean. Regions of snow tourism are of special concern. In general, adaptive strategies tend to focus on adapting buildings and infrastructure to extreme weather, developing weather-independent tourist attractions, and, of course, petitioning the government for support.

Given the detrimental influence of the tourist industry on the environment, especially on the climate, it is striking that the discussion on adapting tourism to climate change is not automatically interwoven with mitigation strategies. As a consequence, it could be concluded that, at the moment, changing mass tourism into more sustainable forms (which would include mitigation strategies for climate change and ecological risks) seems rather a pipe dream.

RULE: PROCEED FROM THE CONCEPT OF ADAPTATION TO THE NOTION OF THE CO-EVOLUTION OF CLIMATE AND TOURISM

Adapting social practices already detrimental to the climate to the consequences of climate change could perpetuate the problem while trying to solve it. This certainly applies to the tourism industry. Since cycles of investment are rather short, it seems to make sense for tour operators and travel agencies to interpret 'adaptation to climate change' in terms of minimizing their economic risk. Moral appeals must fail under these circumstances, because actors in tourism are neither aware of alternative practices nor have any incentives to create alternatives on their own.

We should perhaps raise the question of whether the concept of adaptation is an appropriate metaphor to respond to the challenges of human-induced ecological dangers like, for example, global warming. The concept of adaptation was coined by the biological theory of evolution

(Futuyama, 1990), to which it adds an explanation for reproductive success. A new trait increases the capacity of an organism to cope with environmental stresses and pressures and therefore improves its fitness and chances of survival. It does not provide any notion of an economic system adjusting to the needs of other systems or to requirements for mitigating climate change. Therefore, from the vantage point of the concept of adaptation, there is no reason to search for economic practices with little or no climate impact.

This would be different if we relied on the notion of co-evolution. This concept was also based on the biological theory of evolution. Ehrlich and Raven invented this term in 1964 to describe the influences that plants and herbivore insects could have exercised on each others' evolution (Ehrlich and Raven, 1964). Since the term co-evolution expresses the idea that a system, for example a society or an economy, has to adjust to the requirements of maintaining other systems, it became popular in humanities discourse on sustainable development (Jantsch, 1979, Noargaard, 1994).

Schellnhuber, for example, outlines the idea that sustainability science is "simultaneously the objective lesson on man-environment co-evolution and a subjective co-evolving factor of that dynamic of change" (Schellnhuber, 2001). This means that we have to consider that reasoning and theory-building on tourism and climate change are themselves evolving factors, since, as social endeavours, they constitute an integral part of society. Thus, if we proceed from the concept of adaptation to the notion of co-evolution, this may prompt us to envisage new structures of tourism that are not detrimental to the climate, to our bodies or the livelihood of other species.

RESULTS: TOWARDS A CONCEPTUAL FRAMEWORK FOR RESEARCH ON THE CO-EVOLUTION OF CLIMATE AND TOURISM – A SOCIOLOGICAL APPROACH

One of the main characteristics of human action is its creativity (Joas, 1996). Humans have the capacity to change their behavioural patterns without any pressure or constraint from the environment. We are able to change our behaviour just out of curiosity, just to experiment. Therefore, creating structures of tourism that are not detrimental to the natural environment is by no means as difficult as it may seem on the face of it.

Experiments do not emerge from nowhere. Although action is creative, and therefore essentially individual, some general, uniform factors of action could be identified. General action theory (Parsons, 1978) makes two basic assumptions about action in general (Fig. 1). Firstly, every action is structured by cultural elements, social norms, psychological conditions

and behavioural aspects which are related and vary in every activity. This internal structure allows researchers to describe differences in recreational and tourist activities and explain them by reference to rules created by humans. German tourists behave somewhat differently from British and members of the upper class have different needs on a journey than those of the working class. The reasons for these differences are (probably) not to be sought in biological, chemical or physical facts, but in habits and different societal organisations.

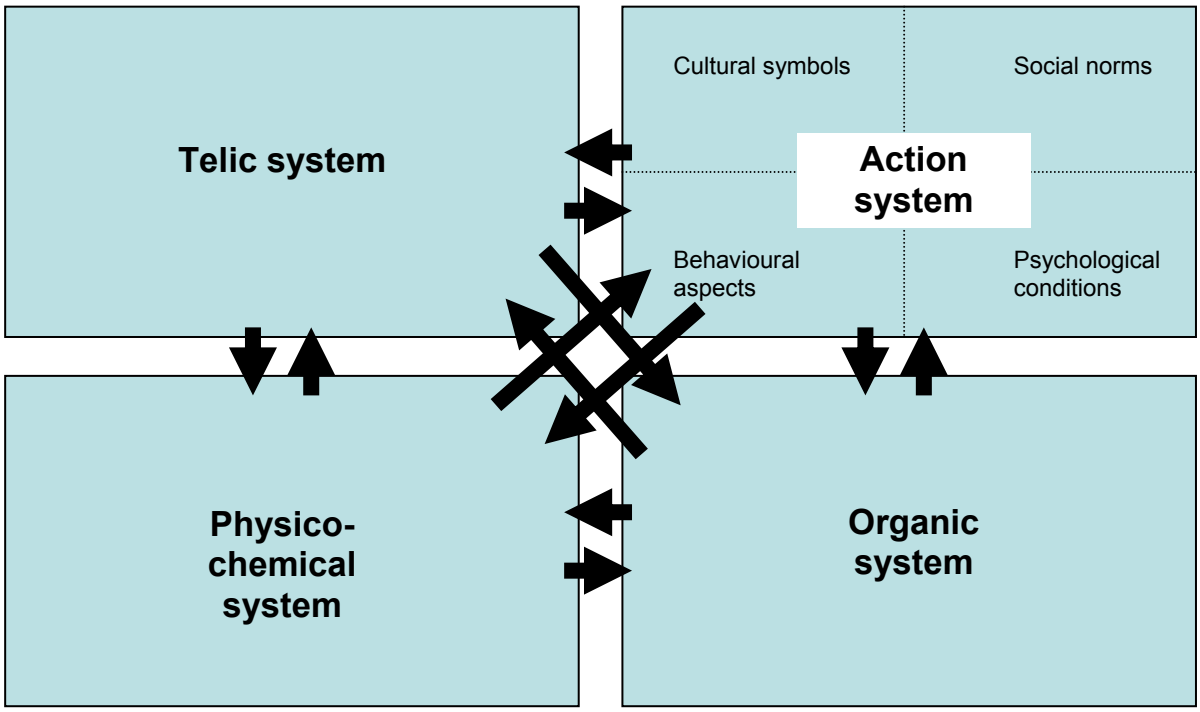

Figure 1: Action, its internal structure and its environments

This leads directly to the second basic assumption of general action theory, which is that every action is context-related. Although the notion of context emphasizes that acting depends on continually changing conditions and possibilities, three different structural aspects of every action can be analytically identified (Parsons, 1978), the physical world, the organic world, and, finally, the 'transempirical' or telic world (Fig. 1). From the vantage point of action the physico-chemical system provides action with empirical order. Climate, for example, is an aspect of this system. The human organic system provides action with well-being and health. It reminds sociologists that every action is related to our bodily existence. On the other hand, the telic system provides action with a transcendental order. It consists of signs representing purposes and ends. Action itself is related to its environments by symbolic meaning. All these different systems interact while we act. However, that does not mean the systems have co-evolutionary relationships. The notion of co-evolution should be restricted to those relations

in which systems adjust to the requirements of each other. Of course, climate itself has no needs, but as a factor of human action it might have.

Looking at Tourism as an activity which is coordinated by its internal structures and at the same time related to its environments by interpreting them, we gain a framework for interdisciplinary research in this field. Different tourist activities require different climatic conditions, need different physical training and cause different bodily conditions and are tied to different purposes like self-awareness, freedom or sustainability. Furthermore, under the conditions of climate change we have to add that different tourist activities have different impacts on the climate.

By adopting the concept of co-evolution (instead of adaptation) we have gained an epistemic goal for further tourism-related research. The tourism industry needs information about desirable, possible and non-desirable forms of practice. Research on, for instance, the co-evolution of tourism and climate (Gössling et al., 2005, Becken et al., 2003) is suited to generating knowledge that may help tour operators, travel agencies, tourism organisations, tourism politicians, travellers and tourists to reorganise their practices in order to adjust to the requirements of maintaining other systems.

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