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Spatial and Temporal Tourist Dispersal Analysis in Multiple Destination Travel

CHENG-LUNG WU AND DEAN CARSON

There is a growing body of literature concerned with the analysis of multiple destination travel and related visitor dispersal. Important aspects of multiple destination trips include the destinations visited (spatial), length of stay (temporal), and mode of transportation along with supply and demand characteristics. Geographic information systems (GIS) offer one way of visualising the results of multiple destination trip analysis, but past attempts to use GIS applications have not incorporated the temporal element. A case study of international and domestic multiple destination trip patterns in South Australia demonstrates how the temporal element may be incorporated in a GIS application to help identify tourists' travel behavior. The application also helps identify differences between markets and may be particularly useful in monitoring change in dispersal patterns over time.

Keywords: *tourist dispersal; multiple destination travel; tourism geographic information system; length of stay*

Many destination marketing organizations (DMOs) encourage dispersal of visitors throughout the destination, particularly where the DMO receives public funding and there are perceived economic benefits arising from local tourism development. In Australia, for example, both the national tourism organization (Tourism Australia) and state tourism organizations (such as the South Australian Tourist Commission) have encouraging dispersal of visitors as a key organizational objective. Dispersal can occur when many visitors travel to a different part of the destination on unique trips, or when a single visitor travels to many parts of the destination within the same trip (multiple destination travel).

Previous research has emphasized the potential importance of information about visitor dispersal, particularly related to multiple destination trips (see most recently, Tussyadiah, Kono, and Morisugi 2006). Conceptual typologies of multiple destination travel have been proposed, building on the work of Lue, Crompton, and Fesenmaier (1993) and Mings and McHugh (1992). Lue, Crompton, and Fesenmaier (1993) suggested five distinct trip patterns, among which four patterns involved multiple destinations. Mings and McHugh (1992) suggested four trip patterns, two of which necessitated multiple destinations and a further pattern (fly-drive) commonly included multiple destinations. Lew and McKercher (2002) suggested seven trip patterns, six of which involved multiple destinations.

There has been some research suggesting that different markets follow different travel patterns within the same destination. Tideswell and Faulkner (1999) and Bowden (2003) have examined the different multiple destination trip characteristics of international visitors to Queensland, Australia, and China, respectively. Their work emphasized that dispersal patterns "are not random" (Bowden 2003, p. 257), but may systematically arise from visitor characteristics (including nationality, but also socioeconomic and other characteristics). Bowden recommended further research examining the relationship between destination and demand-side attributes and patterns of dispersal. There was a particular emphasis on integrating demand-side variables in the analysis, but more work also needs to be done on how travel patterns are themselves described.

There are challenges involved in conducting multiple destination dispersal studies and describing their results. It is not always clear what is meant by a "destination" (Hwang and Fesenmaier 2003; Leiper 1989). Aggregations of multiple destination trips rapidly become difficult to analyze as the number of possible itineraries increases dramatically for each new destination allowed. Important aspects of multiple destination trips appear to include the destinations visited, the order in which they are visited, the direction of travel and route selection, the mode of transportation, and the length of time spent in each destination. Mode of transportation is important because different modes allow for different levels of interaction with transit zones and consequently have different environmental, social, cultural, and economic impacts (Becken 2002). The temporal element is likewise important in assessing impacts, but also has broader

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applications in marketing destinations and making investment decisions.

Following Tussyadiah, Kono, and Morisugi (2006) and Hwang and Fesenmaier (2003), arguments can be made that a better understanding of multiple destination trips and subsequent tourist dispersal would help tourism agencies and enterprises make better planning, management, and marketing decisions. The continuing increase in leisure travel internationally and the increased mobility of tourists arising from the use of personal or hire vehicles and other forms of ground transportation, suggests that understanding dispersal will become a more important consideration. In Australia, there has been a significant increase in traveling by car and fly-and-drive tourism in recent years (Prideaux 2000a; Taplin and McGinley 2000). Discount air tickets offered by major and low-cost carriers have also significantly boosted interstate travel demand in Australia (Prideaux 2000a, 2000b; Tideswell and Faulkner 1999). The higher car-possession rate and the affordability of rental vehicles at popular destinations might improve the mobility of tourists (even those who fly to an initial destination) and consequently increase the exposure of regional destinations (Carson and Waller 2002). On the other hand, there is some anecdotal evidence that lower cost fares result in less dispersal from gateway destinations (Australian Broadcasting Corporation 2006).

There is other evidence that dispersal patterns might change, both as a result of supply-side factors (the opportunities to undertake activities at different locations) and demand-side factors (the desire to visit multiple destinations in a trip). Rising fuel prices and changing travel patterns, particularly among older travelers, are relatively recent influences on the marketplace. Their impact is poorly understood and may limit dispersal. An aging population with a desire to undertake leisure travel and an "explorer's mindset" might encourage greater dispersal by some markets (Muller and O'Cass 2001; Prideaux, Wei, and Ruys 2001). At the same time, the less adventurous nature of backpacker travel to Australia over the past 5 or 10 years (Carson, Boyle, Hoedlmaier 2007) and the less independent and adventurous travel preferences of the growing Asian markets (Pan and Laws 2002) might mean less dispersal.

Visualization of the results of dispersal studies has commonly included graphic representations (Bowden 2003; Williams and Zelinsky 1970), text or tables identifying linked destinations (Hwang and Fesenmaier 2003), and summary statistics identifying the number and type of linked destinations, but not the location (Tideswell and Faulkner 1999). Forer and Simmons (2002) showed that geographic information systems (GIS) could be useful in helping visualize the patterns of visitor movement to, from, and within destinations. They depicted the direction and volume of travel between pairs of destinations in New Zealand. By combining destination pairs, they created a particular view of visitor dispersal across the destinations. The view was limited, however, by the lack of attention to other aspects of multiple destination travel, particularly the temporal aspect.

There is a growing body of literature examining the role of GIS in tourism both from a management perspective and as a tool to enhance the visitor experience. Hasse and Milne (2005) documented a range of tourism planning and management applications for GIS. Hasse and Milne proposed using GIS as a tool to facilitate participatory approaches to

tourism planning. GIS models have also been developed to investigate the spatial behavior of tourists traveling in a national park or in a wider region, such as the South Island of New Zealand (Bishop and Gimblett 2001; Forer and Simmons 2002; Forer, Simmons, and Chen 2002; Itami et al. 1999). Consumer oriented applications for GIS include location based systems (Zipf and Malaka 2001), in-vehicle navigation and information systems (Console et al. 2003), and trip-planning software (Kumar, Singh, and Reddy 2005). GIS has proven particularly useful for tourism applications given the essentially spatial nature of tourism activity and a long history of map use by tourists, tourism businesses, and tourism management agencies. With increasingly sophisticated technologies available, it is likely that new tourism GIS applications will continue to emerge.

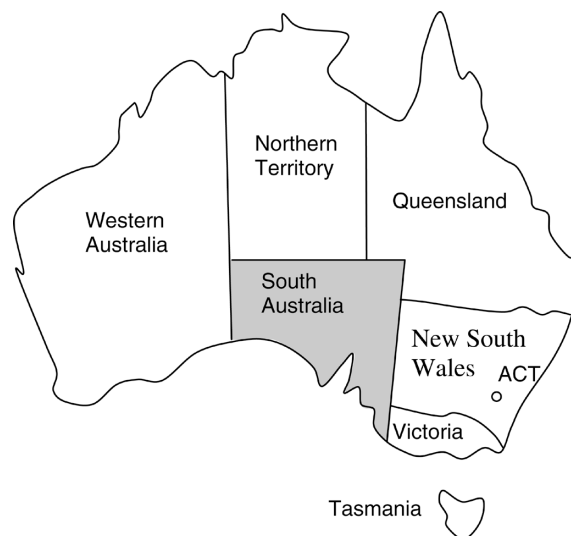
This research aims to contribute to visitor dispersal research by integrating the temporal aspect into descriptions of multiple destination trips. This is done through the use of a tourism GIS that is somewhat different than the application used by Forer and Simmons (2002) but uses a similarly structured data set with the key addition being length of stay in each location visited. The method for describing spatial/temporal dispersal is applied to a case study of South Australia. Two broad markets (domestic and international visitors) are used to demonstrate how the use of GIS might aid in the visualization of market differences (following Bowden 2003).

METHODS

Study Region

The site selected for this research is South Australia, one of Australia's eight states and territories. South Australia is located in the south of Australia and is adjacent to Victoria in the southeast, Western Australia in the west, Northern Territory in the north, Queensland in the northeast, New South Wales in the east, and Tasmania in the south (see Figure 1).

FIGURE 1
STATES AND TERRITORIES OF AUSTRALIA



The South Australian Tourist Commission is responsible for tourism marketing and policy advice for the South Australian government (see www.tourism.sa.gov.au). The Commission's 2004-2005 annual report identified the potential for tourism to contribute to economic development across the state and the need for marketing strategies and policy to promote visitor dispersal. South Australia hosts approximately 2.3 million interstate and international visitors each year, and more than 3 million trips are taken within South Australia by South Australian residents. The study period (1998-2002 inclusive) commenced with peak visitor seasons in 1998-2000, but there was a decline in both international and domestic (combination of interstate and intrastate visitors) markets in 2001 and 2002.

The South Australian Tourist Commission identifies the state's main attributes as being food and wine, festivals and events, and nature-based activities. There are 13 tourism regions in South Australia, with the most popular overnight destinations being Adelaide (the capital city), the Limestone Coast in the southeast, and the Flinders Ranges/Outback regions in the north. There are also notable day-trip destinations such as Barossa Valley, Adelaide Hills, and Kangaroo Island.

The United Kingdom, Germany, and other European countries are the main international source markets. Interstate visitors are mainly from Victoria and New South Wales (Australia's two most populous states). There is access by air to all other states and territories, and major road routes to the north, northeast, east, and west. There are train services from Victoria, Northern Territory, and Western Australia. Adelaide has an international airport; however, only about one-third of international visitors to South Australia arrive in Australia directly through Adelaide. Approximately 80% of international visitors to South Australia are engaged in multiple destination trips. The percentage is much lower for domestic visitors with 40% of interstate and just 12% of intrastate visitors being on multiple destination trips. The main forms of transportation to and within South Australia are air travel and private/rented vehicle travel.

Sources of Data

The National Visitor Survey (NVS) is a quarterly survey of approximately 15,000 Australian households undertaken by Tourism Research Australia every year. The International Visitor Survey (IVS) is a quarterly survey of approximately 20,000 international tourists at ports of departure from Australia. The IVS and NVS have been collected in continuous series since January 1998 and provide a rich tourist database to explore. The surveys are collected using a recall process in which respondents to the NVS are asked to detail the two most recent trips taken in the past four weeks, while respondents to the IVS are asked to detail their current trip to Australia. Demographic information of tourists is collected together with overnight locations and transportation modes used for travel.

Overnight destinations recorded in NVS/IVS are based on statistical local areas (SLA), which is a general-purpose spatial unit defined and used by the Australian Bureau of Statistics to collect and disseminate demographic statistics in Australia (see www.abs.gov.au). The only destinations recorded in the IVS and NVS are overnight stops and this

has presented some limitations for spatial analysis of travel patterns, as it presses some limitations on how to factor in day trips and the locations of activities other than overnight accommodation. In spite of these limitations, the NVS/IVS database still contains sufficient details of tourist movements and also provides a suite of additional characteristics of trips (e.g., travel parties, destinations, and transportation modes) for tourist dispersal analyses. Day-trip tourism, however, is likely to be an important source of tourist dispersal in South Australia, particularly in the wine growing and nature-based destinations immediately adjacent to Adelaide. There are sources of data about day trips in South Australia that could be incorporated in a later application.

For this case study, records from the NVS and IVS for the years 1998-2002 (inclusive) were used. There were 15,038 valid trips recorded in the NVS during this period, and 9,401 recorded in the IVS. Some basic trip characteristics of the 1998-2002 samples follow.

Over three quarters (77%) of tourists in the NVS sample originated from within South Australia, and 10% and 6% from Victoria and New South Wales, respectively. Among tourists from South Australia, 91% of trips involved self-drive, compared with 60% from Victoria and 43% from New South Wales.

Since tourists may use more than one mode of transportation to travel on a single trip, other transportation modes, such as public transportation, are also recorded in NVS. Statistics show that 9% of tourists from South Australia use other transportation modes to travel, compared with 39% and 57% from Victoria and New South Wales, respectively. Little overlap was found between self-drive tourists and non-self-drive tourists in transportation modes, showing that domestic tourists tend to use a single transportation mode throughout the whole journey.

In contrast, 34% (3,189) of tourists in the IVS sample used rental cars as a means of travel. However, 57% (5,378) of these tourists also reported using other transportation modes in their trips. The dispersal characteristics of domestic and international visitors are expected to be different as a result of the different transportation modes used. Among international tourists who use rental cars to travel in South Australia, 57% of them make interstate trips before entering South Australia. This is the case for only 5% of domestic visitors.

The average trip length for domestic visitors was 1.2 nights. Only 45% of domestic tourists remained in South Australia on the second day of their trip and the proportion further dropped to 16% by the fifth day of travel. On the other hand, international tourists stayed in South Australia longer with an average trip length of 3.5 nights. On the second day, 89% of tourists remained in South Australia and 61% remained by the fifth day.

GIS Application

Tourist records from NVS and IVS databases were extracted, processed, and stored in a spatial database suitable for data mapping requirements of the GIS application. GRASS and ArcGIS packages were used in this study to test the visualization capability of the GIS. This involves converting destination names into longitude-latitude coordinates for the GIS database and linking tourist movement records with "time" attributes, such that tourist travel patterns

can reveal both the spatial and temporal attributes embedded in tourist survey records. Aggregated tourist travel patterns are then displayed by the GIS onto regional maps of South Australia. Maps generated at discrete times can be combined into an animated map (for example, in GIF format) to help visualize and identify how tourists travel within the region during their trips within a specified travel time window.

RESULTS

The spatial dispersal of the sampled tourists traveling in South Australia is displayed on maps as shown in Figures 2a and 2b and Figures 3a and 3b. The size of solid circles in these figures represents the percentage of tourists staying overnight at each location out of the total tourist samples

FIGURE 2
NIGHT 1 SPATIAL DISPERSAL PATTERN
(a) DOMESTIC; (b) INTERNATIONAL

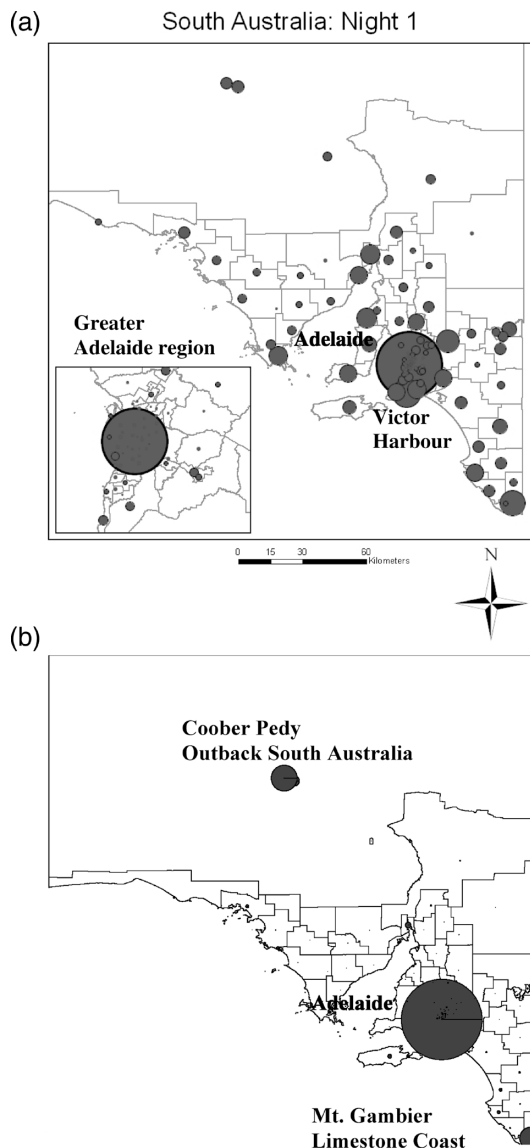
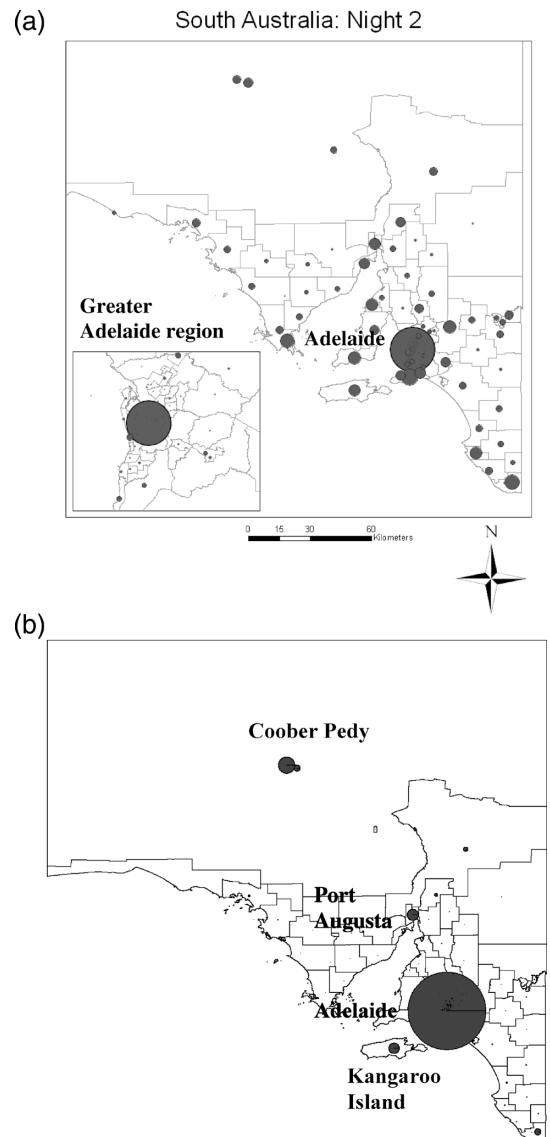


FIGURE 3
NIGHT 2 SPATIAL DISPERSAL PATTERN
(a) DOMESTIC; (b) INTERNATIONAL



starting from the first day (“a” maps) of a trip. Hence, it can be noted that the total number of tourists remaining in South Australia decreased from the first night on as some tourists took shorter trips or continued their trips outside South Australia. This is reflected in the decreasing size of circles on the maps of following days. For comparison purposes, Figure 2b and Figure 3b show the locations where international tourists stay on the first night and the second night.

Figure 2a shows the dispersal of first stopover locations of domestic tourists traveling in South Australia. The majority of these tourists stayed overnight in the greater Adelaide region with the remainder scattering across a range of regional destinations. Adelaide city attracted the highest portion (30%) of tourists staying overnight and Victor Harbour attracted 6% to be the second most popular destination for the first stopover in the state. Other small circles represent stopovers lower than 5%. In contrast, the dispersal of international tourists in Figure 2b shows that the majority

of international tourists spent their first stopover in Adelaide city (37%), Coober Pedy (12%) in the outback South Australia region in the north, and Mt. Gambier (11%) in the Limestone Coast region in the southeast corner. Other regional towns attracted significantly lower percentages of overnight visits, averaging from nil to 2% of the total sampled tourists. This dispersal pattern was found to be significantly different from the one revealed by domestic tourists.

On the second day, domestic tourists still concentrated more in the Greater Adelaide region as shown in Figure 3a, and the total number of these tourists who remained in South Australia dropped sharply from 15,038 to 6,767 tourists. Only 45% (relative to the total tourist number on the first day) of domestic tourists stayed for a second night in South Australia, concentrating around the Greater Adelaide region (15%) and more evenly distributed in regional towns (less than 2%). Compared with domestic tourists, international tourists also concentrated around Adelaide city (shown in Figure 3b) with 8,367 tourists remaining, which was about 11% less in tourist number from 9,401 on the first day. Adelaide city still received 36% tourists (relative to the total number of the first day), while Coober Pedy received 8%, Port Augusta 5%, and Kangaroo Island 5%. Figure 3b shows how international tourists stayed in regional centers when they first enter South Australia and then gradually move toward the state capital city, Adelaide.

On the third day, the dispersal pattern of domestic tourists appeared similar to the second day, though with fewer tourists remaining. Adelaide city still attracted 11% of total sampled tourists, leaving other regional towns with less than 1%. In contrast, 31% of international tourists still stayed around Adelaide city, and Kangaroo Island received the second highest stopover preference of tourists (6%), overtaking Coober Pedy (5%) and Port Augusta (4%). The overall dispersal of international tourists seemed to concentrate more in the Greater Adelaide region including some nearby offshore islands and the nearby Port Augusta region.

The visualization of these findings is improved by animating transitions from one map (one night) to the next and cycling through the animation. This shows a flow of visitors into and out of individual destinations and South Australia as a whole. The revealed temporal and spatial attributes of tourist dispersal become apparent through the changing size of circles on the map. In the South Australian case study, the prominent role of Adelaide is apparent. More than 80% of visitors to South Australia visit Adelaide. Adelaide is an important base for day trips, as well as a starting point for trips to other overnight destinations. GIS can be used to visualize the flow of visitors into and out of Adelaide (see Figures 4a and 4b). Circles are marked at the stopover locations and the circle size reflects the percentage of tourists staying overnight at the location compared with the total tourist number visiting Adelaide. The gray, light gray, and dark circles represent the third, second, and first night stopovers, respectively, immediately before arriving in Adelaide. Figure 4a shows that domestic tourists have few stopovers before arriving in Adelaide. This is seen by relatively smaller gray and light gray circles on the map, compared with the dark ones, representing the stopover location 1 night before arriving in Adelaide.

A statistical study of the stopover locations of domestic tourists who had at least one stopover in Adelaide shows that

only 5% made South Australian stopovers the night before reaching Adelaide. In contrast, 15%, 21%, and 38% of international tourists made stopovers 3, 2, and 1 night(s), respectively, before arriving at Adelaide. Figure 4b also shows that the outback South Australia and the Mt. Gambier region in the southeast were the two most popular stopover regions for this group of tourists before reaching Adelaide. This is seen in Figure 4b by bigger gray and light gray circles concentrating at the outback South Australia and Mt. Gambier compared with Figure 4a. The spatial and temporal travel patterns shown in Figure 4b suggest three major entry routes to Adelaide: the outback South Australia from Northern Territory (north), Flinders Ranges from Queensland and New South Wales (northeast), and Limestone Coast from Victoria along the Great Ocean Road (east).

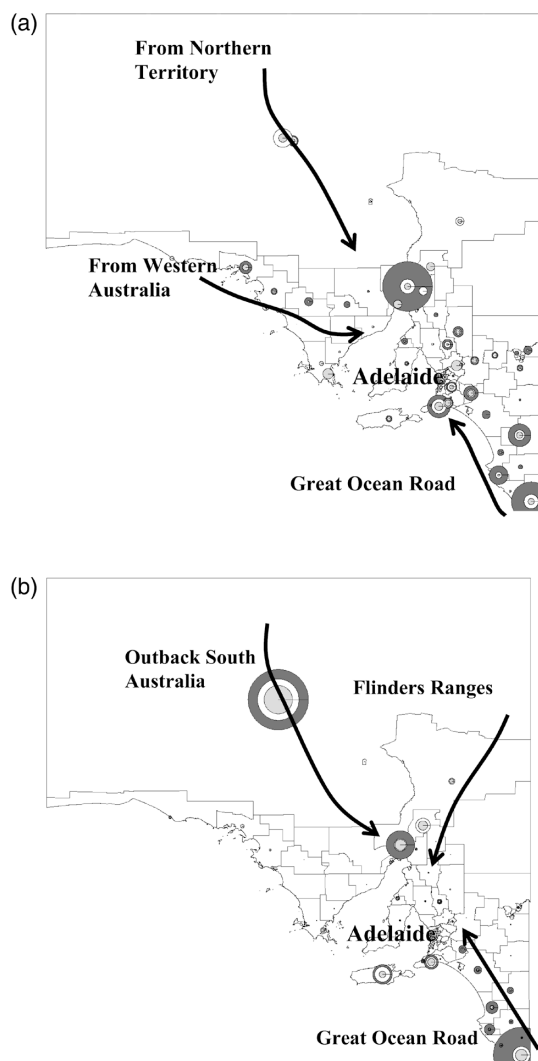
DISCUSSION

Even though the analysis of multiple destination trip patterns for South Australia was limited to the concepts of time and location, and involved the comparison of just two markets (domestic and international visitors), the results have important implications for tourism marketing organizations, such as the South Australian Tourist Commission, tourism businesses, and other stakeholders. The results reveal dramatic differences in the pattern of dispersal of domestic and international visitors. Domestic visitors may be assumed to have greater potential for dispersal arising primarily from greater use of private motor vehicles. On the whole, however, their trips in South Australia tended to be limited to 1 or 2 nights, to be centered on Adelaide with other destinations sharing a relatively low proportion of visits. International visitors, on the other hand, tend to cluster more heavily at a few regional destinations (e.g., Coober Pedy, Limestone Coast, Kangaroo Island) and use a combination of transportation modes to do so.

The temporal factor seems to have less impact on the dispersal of domestic tourists in South Australia. Figures 2 and 3 illustrate that the spatial distribution patterns of domestic tourists did not change too much from day one to day two, except the decreasing number of tourists. When this spatial dispersal phenomenon is compared with that of international tourists, it is found that international tourists concentrated more at major cities in the beginning of the tour, then gradually traveled from outer regions toward Adelaide city. This pattern sharply reflects international tourists traveling to South Australia from neighboring states and making stops at major regional destinations along the way to Adelaide.

The different dispersal behavior of domestic and international tourists implies that different marketing strategies are needed for these two groups. Domestic tourists have a capacity to disperse, and a demonstrated interest in a wide variety of regional destinations that may make domestic tourists better targets for smaller and less developed locations. This may be particularly the case for destinations along the coast in the southeast and in the west. This dispersal pattern did not change much along the time for sampled domestic tourists and indicates that traveling along the coastline is a very popular tourism theme. Tourism operators and businesses in the coastal regions will benefit more if tourists stay longer or visit more frequently. For international tourists, marketers may concentrate on promoting

FIGURE 4
ENTRY ROUTES (a) DOMESTIC; (b) INTERNATIONAL



tourism products at gateway cities, regional centers, and iconic locations because evidence shows that this group of tourists tend to spend some times at these destinations and are limited by the transportation network in terms of their ability to travel independently to other destinations. Development of further transportation facilities, tourism-related services, and key tourism information for travel planning centered on the gateway destinations illustrated in Figure 4b may be an important strategy for enhancing the yield from international visitors.

The visualization of trip patterns emphasized the significant role that Adelaide plays as a tourism hub in South Australia. Flows into the state almost invariably led to a visit to Adelaide, and flows out tend to emanate from Adelaide. While this may indicate that other destinations compete with Adelaide for market share, they also have a dependency on Adelaide as a gateway for day trips and longer visits.

Beyond the case study, the visualization of dispersal patterns is able to increase awareness of the spatial and temporal constraints on visitor dispersal. This might help inform

strategies that encourage dispersal (at the macrolevel applying to agencies such as the South Australian Tourist Commission) and that aim to develop tourism in more peripheral destinations. Higher dispersal is related to higher mobility and the use of self-drive transportation in particular. It may be that increasing visitor numbers to major destinations (such as Adelaide) by air, for example, has limited impact on other destinations unless there is an effective transportation network in place to disperse tourists to regional destinations. International visitors arriving in Adelaide appear limited in their destination choices to those regions serviced by organized tours. As mobility decreases, day trips may also become a more important component of dispersal strategies for this tourist group.

Entry routes are crucial for regional tourism development and tourism operators. The study of South Australian entry routes to the Adelaide region reveals no strong route preferences for domestic tourists, while three entry routes for international tourists are evident (through Outback South Australia in the north, from Flinders Ranges in the northeast, and from Mt. Gambier in the southeast). This has important implications for tourism operators along entry routes because “gateway cities” along the entry routes (either those close to the state border or those major regional towns) may help disseminate travel information and disperse tourists to regional destinations, particularly those not directly on the main entry routes. With the increasing popularity of self-drive tourism in Australia, it is crucial for the tourism industry to identify which routes are popular to certain groups of tourists and what roles destinations along the routes may play to facilitate travel. A slight detour from the main entry routes to nearby destinations might bring significant economic benefits to local businesses.

CONCLUSIONS

The relationships between space, time, and modes of transportation are of central importance in situations where greater dispersal of tourists across related destinations (such as within a single political jurisdiction) is an imperative of the tourism industry or government. While there has been substantial work done on describing patterns of dispersal demonstrated by multiple destination travelers, the lack of attention to the temporal element has been an oversight. There has also been only limited use of GIS applications to help visualize trip patterns. This project has used a relatively simple method to map the flow of visitors around a set of destinations over the length of a multiple destination trip. The aggregate analysis of these trip patterns has revealed important differences between the two broad markets used here and provides a readily interpretable output showing how different destinations play different roles for different markets. Adding the temporal element to the process of analysis has been particularly useful in revealing how different trips are structured and assessing how effectively key destinations play the role of gateways to further travel.

Manipulation of the data for the GIS application was relatively straightforward. It is probable that there are other applications for spatial analysis of tourism (visitor) data that have yet to be identified. The map formats themselves may be enhanced by the addition of layers covering infrastructure, transportation networks, attractions, population

centers, and so on, both to make them look more like the sorts of maps used for other tourism purposes and to add to the visual effect by seeing the relationship between infrastructure and the selection of overnight stops (and other destinations). The application would be particularly powerful if the changes in these relationships could be demonstrated over time. Actually seeing the different dispersal patterns before and after an intervention, such as a new airport, new marketing campaign, or change in infrastructure, would be a powerful decision support tool for DMOs.

This case study was limited in terms of the types of destinations it allowed (overnight stops only) and the integration of the GIS application with market descriptors (beyond the distinction between domestic and international tourists). A number of relationships were posited on modes of transportation, levels of organization of the trip, propensity for day trip travel, and so on. Further research may use the GIS application described here to explore these relationships in a more empirical way. Likewise, the management applications discussed in brief in this article were largely to do with encouraging dispersal and managing visitor yield. The distribution of visitors throughout a destination and across destinations has broader implications, including discouraging dispersal to help manage environmental or cultural impacts, for example. Regardless of the management scenario, understanding where visitors are likely to be at different stages in their trips—where they just visited before they arrived at this destination, where they are likely to visit next, how many days it is likely to take them to make the journey—is critical in deciding the provision of travel information, infrastructure, attractions, and amenities.

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