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HUMAN SYSTEMS

MOBILITY PATTERNS AND USE OF SPACE IN GALAPAGOS

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Photograph: Josselin Guyot-Téphany

Mobility patterns and use of space in Galapagos

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Introduction

The human history of Galapagos has been one of progressive reduction of the ecological isolation that allowed the evolution of unique species. In the Galapagos Report 2009-2010, an article on this topic details the process of geographic opening (Grenier, 2010), and three other articles discuss transport issues in Galapagos: the results of the first vehicle census (Oviedo *et al.*, 2010), taxi mobility in Santa Cruz (Cléder & Grenier, 2010) and inter-island passenger boat transportation (Ouvrard & Grenier, 2010). Continuing this line of research, this article presents a study of mobility on each island, between islands, and between the archipelago and the mainland. The study is based on the results of the survey entitled "Population Mobility in the Galapagos," whose aim was to analyze the spatial distribution of the different flows of people (origins and destinations), and the means of transportation and patterns of movements (vehicles used, reasons and frequencies). The results complement previous research and, together with the other articles on mobility in this edition of Galapagos Report, will form the basis for the development of a shared vision on mobility in Galapagos.

Methodology

The Charles Darwin Foundation (CDF) conducted a series of surveys in three of the inhabited islands of the archipelago between October 2010 and March 2011. In total, there were 500 valid surveys: 298 in Santa Cruz, 127 in San Cristóbal, and 70 in Isabela. When designing and conducting the survey, numbers per island were based on the 2001 Census (the most current demographic data). A subsequent comparison with the 2010 Census showed that the selected sample corresponds to the actual population distribution among the islands, and between the port towns and highlands, within a margin of error of +/-10%. This ensures that the data collected has good geographical representation. The survey consisted of 69 questions covering 247 variables (190 closed ended and 57 open ended). In order to minimize errors in the formulation and interpretation of the questions, quantitative and semi-quantitative variables were used. Detailed methodology, complete questionnaires, and an exhaustive analysis of the results can be found in Téphany-Guyot *et al.* (2012).

Increase in traffic flow

The geographic opening of the Galapagos Islands has generated a rapid and disorderly growth in the transportation system in the archipelago. The average annual increase in the number of terrestrial motor vehicles has been 7.7% since 1998, outpacing the population growth [annual average of 3.3% between 2001 and 2010 according to the Census of Population and Housing (CPV – INEC, 2010)].

This demonstrates that the restrictions established in 1997 to limit the entry of new motor vehicles have not achieved the expected results (Table 1). As for marine transportation, since 2004, small passenger launches have replaced the larger public transport boats, increasing interisland mobilization. In 2009 it was estimated that the number of rapid launches operating was approximately

44 (Ouvrard & Grenier, 2009). At present the number of boats engaged in this activity is not clear. With regard to air transport, the number of commercial flights to the Galapagos has risen from 17 weekly flights (only to Baltra) during 2001 to 40 weekly flights (34 to Baltra and 6 to San Cristóbal) in 2011.

Table 1. Laws and regulations that have been implemented to regulate terrestrial transport in Galapagos.

Year	Law or regulation	Objective
1997	Second supplement, Official Register N°55	First regulation of vehicles in Galapagos. It restricts the entry of new terrestrial vehicles to the conservation and agriculture sectors and for replacement of vehicles already in the province.
1998	Special Law for Galapagos: Ley Orgánica de Régimen Especial para la Conservación y Desarrollo Sustentable de la Provincia de Galápagos	INGALA was delegated to have jurisdiction over the determination of the number and type of terrestrial vehicles that enter Galapagos.
1999	INGALA Resolution No. 002-CI-IV-99	5-year moratorium on the entry of vehicles.
2005	INGALA Resolution No. 02-18-CI-2005	5-year moratorium on the creation of new terrestrial transportation cooperatives and for any new operation permits.
2009	INGALA Resolution No. CI-11/ 12-II-2009	Establishment of a committee, headed by the president of INGALA, to issue entry permits for new terrestrial vehicles based on environmental criteria.

The uncontrolled development of the land transportation system is reflected in the increasing motorization of mobility. The survey shows that about 20% of the study population in Santa Cruz and nearly 33% in San Cristóbal and Isabela have access to a motor vehicle (personal, borrowed or rented). Even so, access to such

transportation is limited to a minority of residents. The use of private motor vehicles is less common than the use of bicycles: 13% of the study population used a motorcycle or scooter more than once a week and less than 10% used some other type of motor vehicle, compared with 45% who used a bicycle at the same frequency (Figure 1).

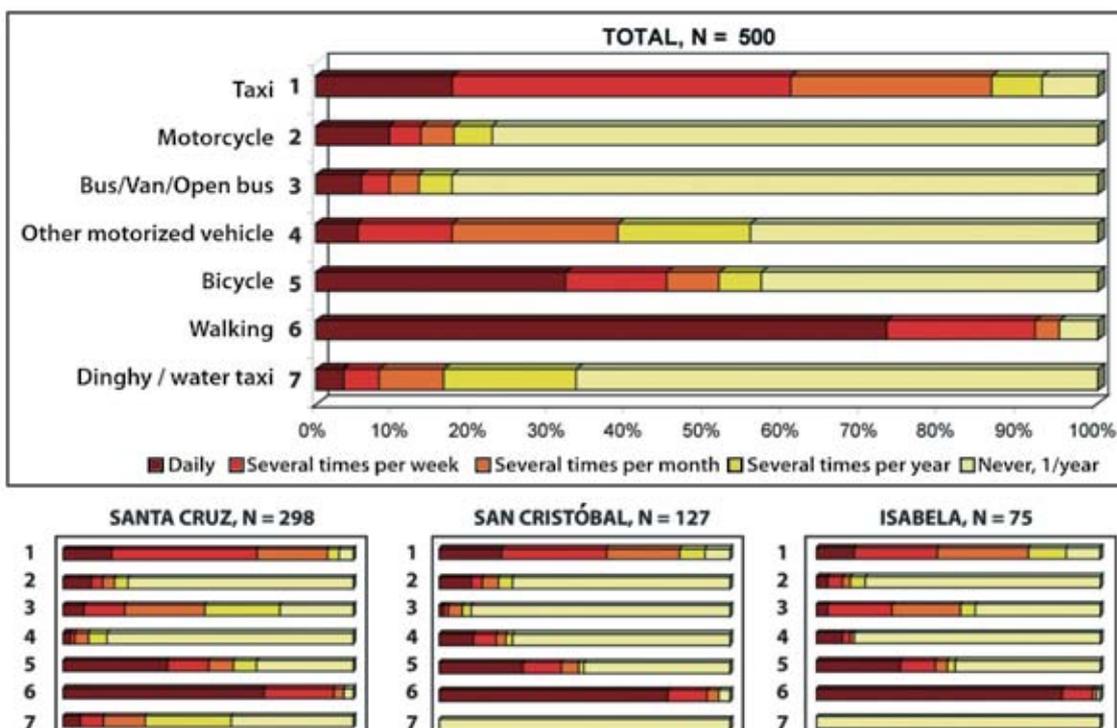


Figure 1. Frequency of use of each means of terrestrial transport in Santa Cruz, San Cristóbal and Isabela.

Moreover, although they represent less than 20% of the motor vehicle fleet in the Galapagos, taxis are the most common means of transport after walking: 60% of the study population used a taxi more than once a week (67% in Santa Cruz, 57% in San Cristóbal, and 43% in Isabela).

Finally the absence of effective regulation of the vehicle fleet reduces the role of public transportation. Although Santa Cruz and Isabela have buses running between the port towns and the highlands, no more than 25% of survey respondents in either island used this means of transport more than once a week.

While non-motorized mobility is more frequently used than motorized mobility, the latter is gaining ground in the same way on all three islands. First, the type of mobility is related to socioeconomic categories. Higher

socioeconomic classes have an “urban-continental” lifestyle: they stop walking and instead use private motor vehicles (see details Guyot-Téphany *et al.*, 2012). Lower socioeconomic classes without access to private vehicles stop walking in favor of travel by taxi or bus. Secondly, the increased use of private motor vehicles and taxis is the result of the double demand to travel both faster and farther (Table 2), which is closely related to the ever-expanding urban space. More motorized vehicles allow residents to live farther from their workplace, which in turn increases the need for more vehicles. Finally, protection from the weather (sun, heat or rain) provided by vehicles, as well as the ease of transporting cargo, are additional important reasons for using motorized vehicles. On the other hand, there are environmental and health considerations, which favor walking or using bicycles or buses (Table 3).

Table 2. Reasons for using private motorized vehicles or taxis more than once per week.

Reason	Santa Cruz (N = 215)	San Cristóbal (N = 92)	Isabela (N = 45)	Total (N = 352)
Save time (quicker)	92%	79%	82%	87%
Long distances	76%	69%	75%	74%
Transport cargo or purchases	60%	47%	71%	58%
Requires little physical effort	44%	54%	39%	46%
Lack of alternative (public transportation)	47%	43%	46%	46%
Protection from weather conditions	64%	77%	61%	67%
Health problems	28%	36%	20%	29%

Table 3. Reasons for walking, using bicycles or mass transit more than once per week.

Reason	Santa Cruz (N = 275)	San Cristóbal (N = 121)	Isabela (N = 74)	Total (N = 470)
Galapagos is a special place	97%	83%	95%	93%
Reduce environmental pollution	96%	93%	95%	95%
Better for health	94%	82%	96%	91%
Save money	80%	68%	58%	73%
Freedom to come and go at any time	88%	86%	97%	89%
Short distances	59%	78%	51%	63%
Lack of economic resources	31%	42%	28%	33%

The continued expansion of the land transportation system and the increased speed of travel represent major changes in the island lifestyle. Survey respondents describe a paradox: while many people feel that it has become necessary to mobilize via motor vehicles, they also believe that walking or bicycling is much more adapted to the island environment and a healthy lifestyle (often relating it to “living well” or *buen vivir*).

The increase in vehicles and the ever-increasing flow of traffic are phenomena that occur at every level of mobility in the archipelago. The growth of marine transport has permitted a daily connection between the port towns

on the different islands and has halved the travel time between islands, producing a sense of “closeness” that further accelerates and expands the effects of geographic opening on all inhabited islands. According to the survey results, the ecological impact of the passenger launches (pollution and death of marine animals), as well as the disorganized nature of the transportation companies, are perceived by residents as necessary evils to have a faster and cheaper marine transportation system bringing the islands closer to one another. During the past five years, respondents in Isabela have traveled an average of six times per year to another island, those on San Cristóbal four times, and those on Santa Cruz two.

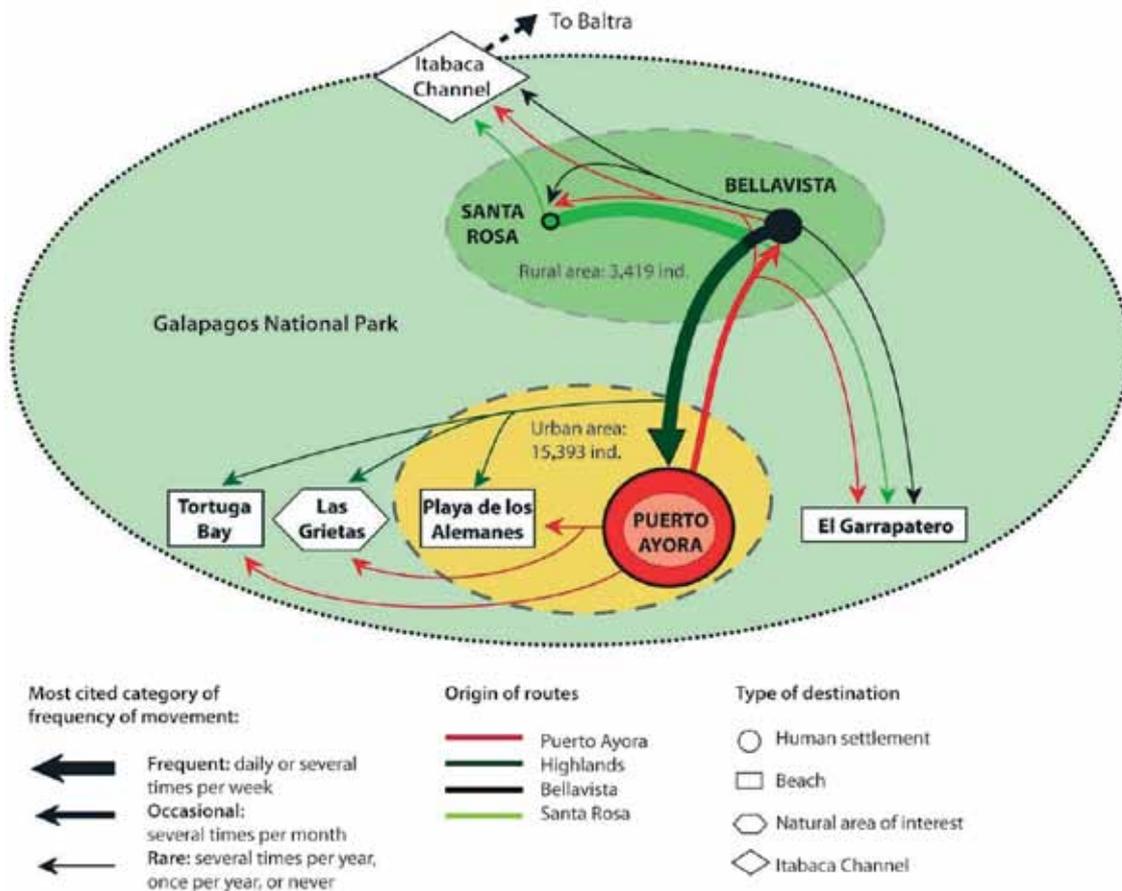
Similarly, the increase in the number of commercial flights to Quito and Guayaquil makes travel to the mainland easier. Two-thirds of respondents have traveled to the continent at least once during the 12 months prior to the survey, with the average number of trips for all respondents during the same period equal to 1.26 in Santa Cruz, 1.31 in San Cristóbal, and 1.65 in Isabela. As with terrestrial mobility, the frequency of travel by sea or air is related to sociological variables: higher socioeconomic classes have higher rates of travel between islands and between the islands and the mainland.

Transforming island space into urban networks

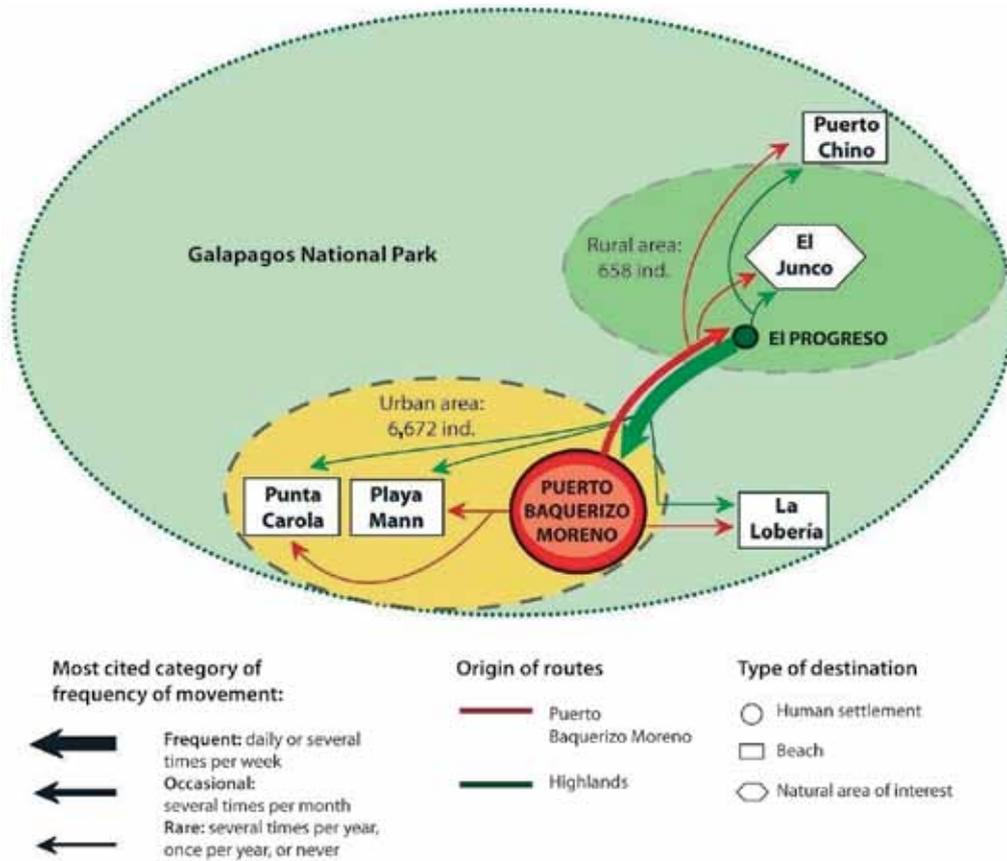
The use of ever-faster vehicles to move from one place to another significantly reduces access times between physically distant locations. Rapidly increasing mobility, in addition to producing serious environmental impacts such as increased bird mortality along the Puerto Ayora

– Itabaca Channel road (Jiménez-Uzcátegui & Betancourt, 2008) and reducing safety conditions in both land and maritime transport (see details in Guyot-Téphany *et al.*, 2012), ruptures the ecological isolation of the island ecosystems that guarantees biological uniqueness. The flow of people forms mobility networks that cross natural areas to connect the towns to one another.

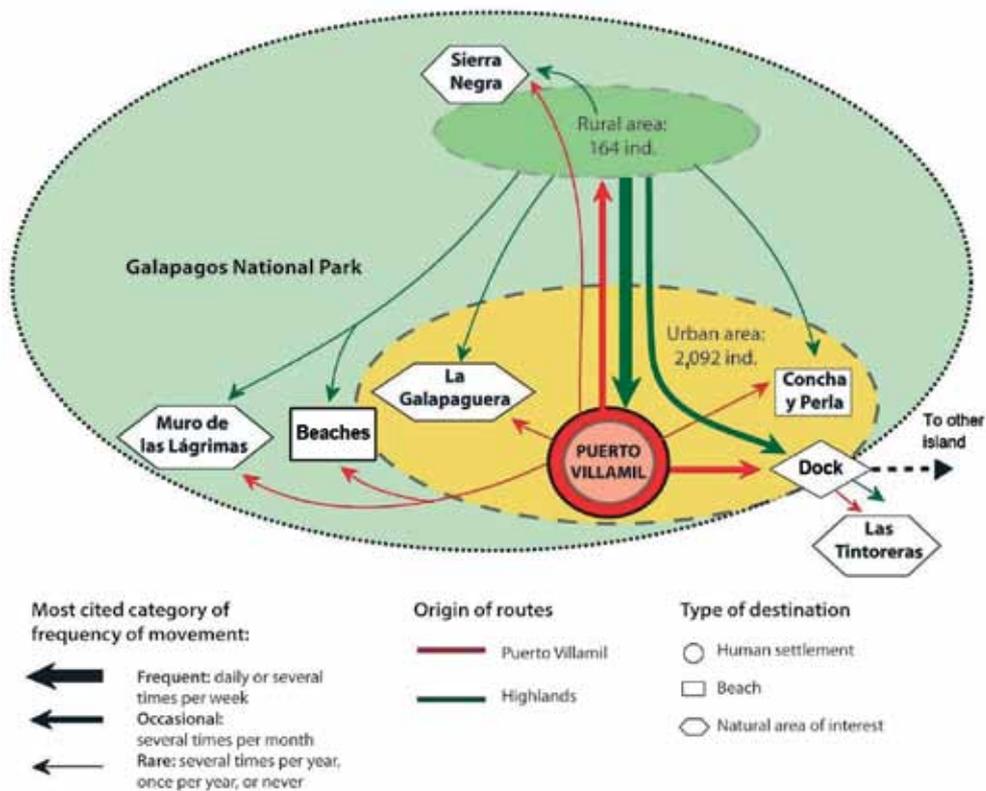
The greatest terrestrial flows of people are between the ports and highland villages (Maps 1-3). Bellavista, Santa Rosa and El Progreso are frequently the source of flows (daily or weekly) to Puerto Ayora and Puerto Baquerizo, where both jobs and economic services are concentrated. Thanks to motorized vehicles, the rural highland villages “grow nearer” to the ports, and are slowly converted into residential suburbs. In comparison, the beaches and natural sites are infrequently visited destinations (several times a year, once a year or never); they “grow farther” from the ports, revealing a progressive enclosure of the urban island population.



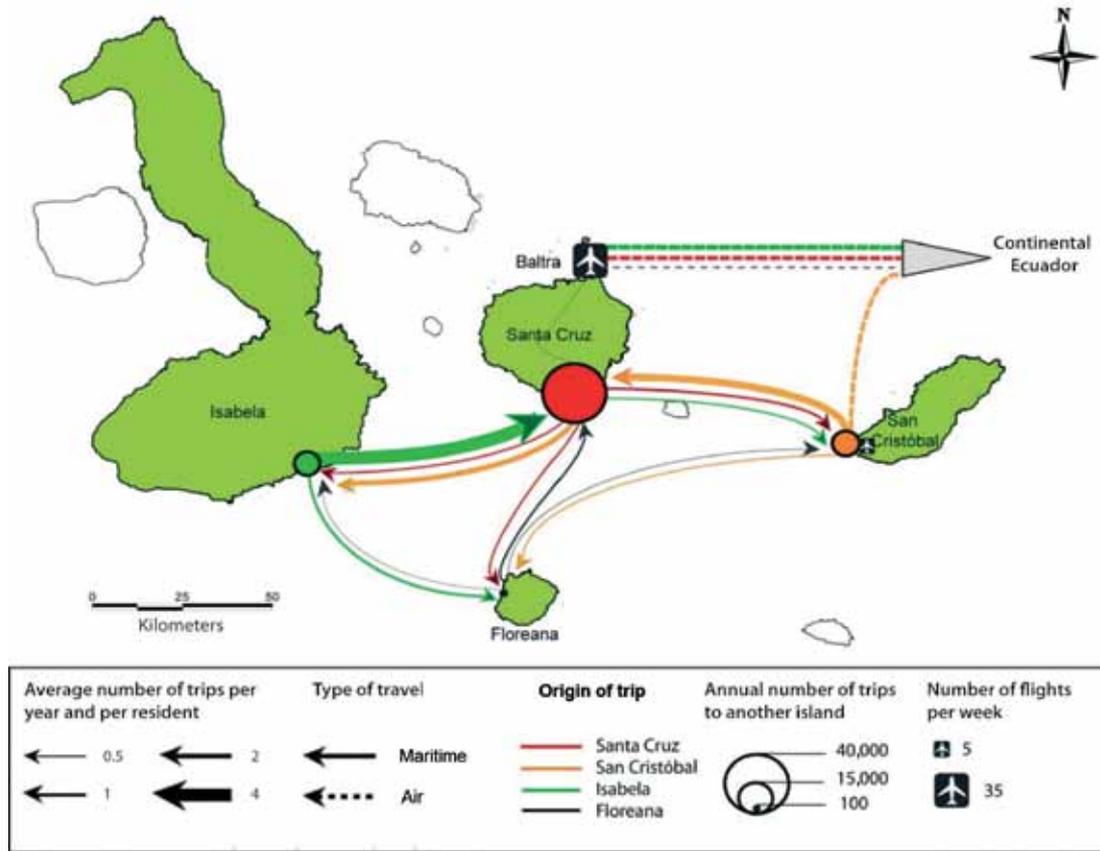
Map 1. Terrestrial mobility scheme in Santa Cruz. Author: Guyot-Téphany J., CDF, 2011. Source: Mobility Survey, N=500, Cléder E., CDF, 2010/2011, INEC CPV 2011



Map 2. Terrestrial mobility scheme in San Cristóbal. Author: Guyot-Téphany J., CDF, 2011. Source: Mobility Survey, N=500, Cléder E., CDF, 2010/2011, INEC CPV 2011



Map 3. Terrestrial mobility scheme in Isabela. Author: Guyot-Téphany J., CDF, 2011. Source: Mobility Survey, N=500, Cléder E., CDF, 2010/2011, INEC CPV 2011



Map 4. Interisland mobility and mobility between the archipelago and the continent. Author: Guyot-Téphany J., CDF, 2011. Source: Mobility Survey, N=500, Cléder E., CDF, 2010/2011, INEC CPV 2011

The ports are the center of terrestrial mobility and the sites where each island becomes more accessible to the other islands of the archipelago. The maritime flows of people are directed from the ports of the less populated islands to those of the more developed islands (Map 4), revealing the interdependence that has developed

between the islands: Puerto Ayora is the economic center of the archipelago; Puerto Baquerizo Moreno is the political capital and secondary economic hub; and Isabela is on the periphery of development. Maritime mobility is a way to overcome being in a peripheral location in the archipelago.

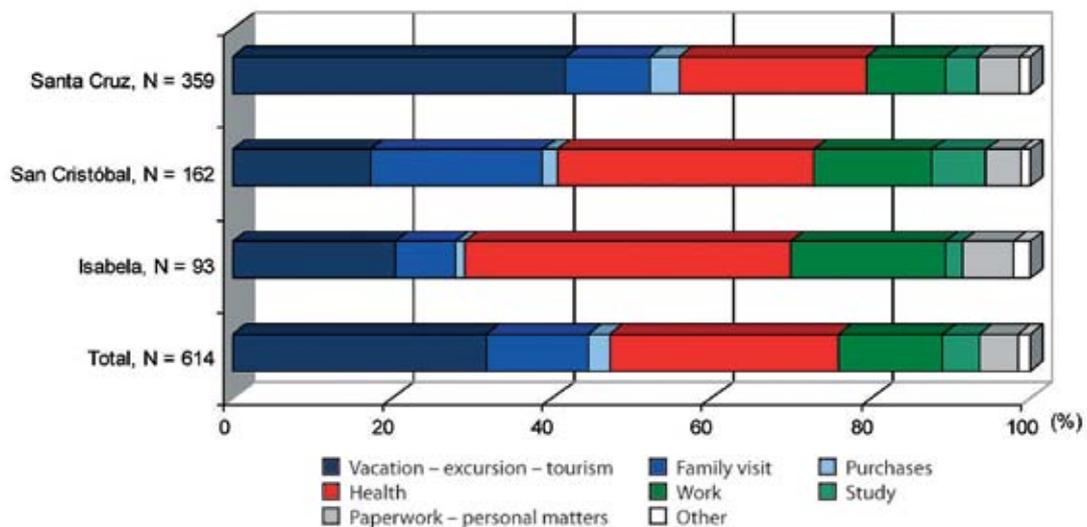


Figure 2. Reasons for the last two trips to the continent.

The insular urban network is connected to continental space through the airports of Baltra and San Cristóbal. Survey respondents travel to the mainland to offset social isolation (lack of relationship with family and friends), lack of services (administrative, educational and especially medical), or lack of entertainment (vacations) (Figure 2). Air mobility is a way of overcoming the insular life in an urban island environment increasingly connected to the outside (by reducing access times) and disconnected from the natural environment. Guayaquil, Quito and Ambato are the destinations of 75% of trips to continental Ecuador. The continued connection with continental culture influences the rapidly changing lifestyle in Galapagos toward urban living.

Conclusions and recommendations

The geographic opening of the Galapagos Islands is a phenomenon that is both cause and consequence of the steady increase in the mobility of the island population. On one hand, the uncontrolled development of transport, engine of the geographic opening, generates intense human flows at all levels. On the other, the reduction in access times between physically distant locations generates increased demand for transport in an insular urban network more closely connected to the mainland than to its own natural surroundings.

This mobility model is unsustainable. First, the acceleration of flows generates environmental impacts and reduces transport safety. Secondly, the acceleration of the flow in a doubly limited space (physical limits of each island and boundaries of each populated area) causes a sense of urban enclosure that in turn encourages people to travel to the mainland more frequently. Finally, the transformation of island spaces into urban networks threatens the biological uniqueness of the Galapagos, which is its main tourist attraction.

Based on the results of the study, we recommend the following actions:

- Strengthen enforcement of the law to effectively limit the entry of new terrestrial motor vehicles into Galapagos.
- Create a targeted subsidy scheme to encourage public transport and discourage personal motorized transport.
- Encourage non-motorized land mobility by improving infrastructure, such as the extension of sidewalks and public spaces in urban areas, extensive implementation of safe bicycle lanes, and additional infrastructure such as parking areas, safety zones, etc.
- Encourage public transit by improving bus services between ports and highlands, and implementing a public transit service in Puerto Ayora and Puerto Baquerizo Moreno.
- Organize marine transportation, implementing a quality public transport service between ports with larger, more comfortable and safer boats that have low environmental impact.
- Improve basic health and administration services to reduce dependence on the continent, thus reducing the number of trips per person.

Acknowledgments

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