SPATIAL AND TRANSPORT PLANNING
INTEGRATED POLICIES:
GUIDELINES FOR NORTHWEST SPAIN

Henar Salas-Olmedo
Transport Studies Unit, University of Oxford
Universidad de Cantabria, Spain

Working paper Nº 1034

July 2008

Transport Studies Unit
Oxford University Centre for the Environment

http://www.tsu.ox.ac.uk/
SPATIAL AND TRANSPORT PLANNING INTEGRATED POLICIES.
GUIDELINES FOR NORTHWEST SPAIN

1. Background – conceptual and spatial framework ........................................... 3
   1.1. Urban development strategies .................................................................. 3
       1. The dispersed city – is there a relationship between zoning and sprawl? ...... 3
       2. The compact city – a sustainable strategy? ............................................. 4
       3. The decentralised concentration or polycentric development – are PURs the spatial strategy to follow? ................................................................. 5
   1.2. The Northwest Spanish Region .................................................................. 8
       1. Physical characteristics and transport infrastructure disposal .................. 9
       2. Population and settlement pattern .......................................................... 9
       3. Economic activities .................................................................................. 12
2. Criteria, integrated policies and institutional issues ............................................ 12
   2.1. What strategy would be more suitable for a peripheral area? ..................... 12
   2.2. Land use and transport policies and their integration ................................ 14
   2.3. The indispensable institutional co-operation ............................................ 17
   2.4. Recommendations for Northwest Spain .................................................... 19
3. Conclusions and further research ..................................................................... 25
References ............................................................................................................ 26
1. Background – conceptual and spatial framework

Regional land use patterns are the result of both regional spatial strategies, if they exist, and urban planning policies at the local level, in addition to sectoral policies related to transport, infrastructures, economy, etc. and the regional cultural heritage.

An explanation about the existing spatial strategies of urban development and a brief description of the study area is needed in order to understand the key objective of this paper: to suggest some guidelines to Northwest Spain spatial strategies through the integration of land use and transport policies. The following sections address these two issues.

1.1. Urban development strategies

Nowadays, spatial patterns can be divided into three main categories, each one deriving from different land use strategic policies. These three groups are well known as the “dispersed city”, “the compact city” and the most recently highlighted “urban network” or “polycentric development”.

Nevertheless, in the real world urban structures are hybrids that are the result of different strategies over the history. Ma and Banister (2007) point out that many compact or monocentric cities have developed decentralised patterns, diminishing credibility to the central city model. Anas et al (1998) explain the continuous spread of the city as the origin of this multi-centred developing process, suggesting two versions: centres may come from existing settlements that become absorbed by main city’s spread; or centres may arise at high accessible transport nodes.

The following sections briefly review the main features of each theoretical spatial pattern; however real mixtures should not be forgotten.

1. The dispersed city – is there a relationship between zoning and sprawl?

The industrialization process set a turning point in the urban development of western countries, where congestion and pollution problems were arising (Grant, 2002). Zoning policies avoiding the mixture of some land uses were adopted in both U.S. and European countries with the main objective, as Hirt (2007) states, of improving the quality of life on residential and working areas. The Athens Charter (Le Corbusier, 1943) gave support to this planning approach.

This car-oriented development strategy involves additional transport needs. In fact, it has largely been enforced during the last century thanks to transportation improvements, both on road infrastructure and private vehicles, and the modern lifestyle requiring more and more qualified space for residential areas.

The separation of potentially hazard land use combinations is clearly the basis of zoning policies, but Hirt (2007) distinguishes between the American and the European point of view and practical application. She explains how American zoning is based on single-use areas, where residential units do not get mixed with other uses, in contrast with German and generally European planning, which allows the mixture of residential buildings and small commerce units.
Despite sprawl cost and benefits debate (articles by Ewing, 1997 and Gordon and Richardson, 1997, among others, are a good example), zoning is considered to be one of the many factors that has lead to this spatial pattern, where urban development spreads extensively in a low density form.

Galster et al (2001) deep in the definition of this ambiguous concept. After an extent academic literature review, they define and measure eight features in which sprawl gets low marks: density; continuity; concentration; clustering; centrality; nuclearity; mixed uses and proximity. Finally, they measure six of these dimensions on residential uses because of time and operational restrictions, and welcome further research on measure simplification and non residential application.

No more than a year later, Smart Growth America published a report on the same issue: how to define and measure sprawl, and what are its consequences on people. In this report, Ewing et al (2002) reduce Galster et al’s eight dimension definition and measurement of sprawl to four key factors that are the origin of many other associated features. These defining factors, in which different forms of sprawl get low marks, are: residential density; neighbourhood mix of homes, jobs and services; strength of activity centres and downtowns; and accessibility of the street network.

They applied 22 measures to characterize not only the degree to which each of the 83 metropolitan areas they studied were sprawled, but the relationship between sprawl and the quality of life (basically related to accessibility and health issues). The conclusion is that the more sprawl degree, the higher rates of driving and vehicle ownership; the higher levels of ozone pollution; the greater risk of fatal accidents and the lower rates of walking and alternative transport use. On the contrary, they did not find a significant relationship with congestion delays.

Apart from the already mentioned different implementation of the zoning concept between America and Europe, there is another major factor that plays a key role in the over sprawled American development compared to Europe, which is land availability. This fact has traditionally led to more compact cities in Europe (Gayda and Lautso, 2007) and it has also constrained to a certain point theirs sprawl process. This factor is essential to understand different points of view coming from American or European authors.

As a result, some authors affirm that social and environmental sprawl costs are declining; whereas others, like Downs (1999), present the unwanted consequences of sprawl, which are related to accessibility; pollution; housing, infrastructure, facilities and energy inefficiency derived from land use segregation; and poverty-related problems in inner city areas.

As a consequence of all these problems associated to sprawl, there is a clear movement towards more sustainable development patterns (Hillman, 1996).

2. The compact city – a sustainable strategy?

In 1990 the Commission for the European Communities published the Green Paper on the Urban Environment, where social and environmental problems derived from the dispersed city were addressed. This paper suggests the renewal of the city to attract business and residents, which, together with public transport improvement, will reduce traffic congestion.
This contribution led to the definition of the compact city as the alternative planning strategy to the dispersed city and the problems linked to sprawl (shortage of public life and accessibility to facilities and commerce, traffic and pollution increase, car-dependency, etc.). Thomas and Cousins (1996) summarize the main characteristics associated to the compact city: intensive use of space in the city; compactness and integration (mixture) of land uses; centralised activity; and growth within the city boundaries.

More recently, Burton (2000), adds the commonly mentioned walking and cycling encouragement together with an efficient public transport system. She also points out the expected benefits of this strategy: 'conservation of countryside; less need to travel by car, thus reduced fuel emissions; support for public transport and walking and cycling; better access to services and facilities; more efficient utility and infrastructure provision; and revitalisation and regeneration of urban areas' (p. 1969).

Nijkamp et al (1996) evaluate four transport and spatial scenarios in the Randstat region looking for the most sustainable one. They conclude that spatial concentration is the most sustainable option. In addition, Thomas and Cousins (1996) show some compact city approaches that have been designed by different authors (Calthorpe, Duany and Plater-Zyberk, Aldous), but they do not agree that these models reach the employment, energy consumption and transportation objectives that the compact city is supposed to fulfil.

Furthermore, the real experience of European cities has eventually shown some problems related to the compact city, such as congestion (Catalán et al, 2008), over development in some areas (Williams et al, 1996) or the absence of clear social equity benefits (Burton, 2000). Neuman (1995) expresses that, as long as long as city life depends on external providers, there is no sustainable model of city, yet city’s sustainability is a function of its inhabitants’ sustainable life.

In fact, current real cities are the result of a historic expansion where more or less compact and dispersed developments coexist, and where cultural and socioeconomic factors have great influence. Van der Waals (2000) is aware of the virtual inexistence of pure compact or dispersed urban areas, and so he prevents from investigations where these pure models are compared in order to extract potential benefits for the environment. Nevertheless, he concludes that preventing sprawl with a not-extreme compactness strategy will increase the potentiality for environmental benefits in the long term.

3. The decentralised concentration or polycentric development – are PURs the spatial strategy to follow?

Once known the advantages and disadvantages that both the dispersed and the compact city have shown, it is time for a new perspective that combines the positive points of such extreme spatial conceptions. From the early 1990s network cities or models and polycentric urban regions (PUR) are the most common names that decentralised concentration receives¹.

Priemus and Zonneveld (2004) show the idea of polycentricity underlying the ESPD, that implies the promotion of medium-sized cities through their endogenous potential

¹ Given the objective and perspective of this paper, polycentrism will be considered here as a spatial strategy, so as it is done by the European Spatial Development Perspective (European Commission, 1999) and the New Charter of Athens (European Council of Town Planner, 2003), leaving the descriptive concept aside (Koolsterman and Musterd, 2001 deep in its definition).
and the cooperation between urban areas as a means to achieve a physically and functional connected region. The key objective is to combine economically growth and social and spatial cohesion.

Some of the possible benefits of a spatial structure based on the interaction between multiple centres are: upgrading the functions of medium sized centres (Capello, 2000); relieving the polarization issue (Catalán et al, 2008); avoiding ‘urban sprawl, excessive car-dependence, inner-city decline and extreme social polarization’ (Parr, 2004) or providing small cities a better chance for competitiveness (Davoudi, 2003).

However, the interaction between spatial planning and changing developments and socioeconomic conditions should be taken into account (Priemus and Zonneveld, 2004). From the empirical evidence, Davoudi (2003) remarks that without functional interactions between the centres and long-term and area-specific policy measures to encourage them there are few chances to succeed.

The POLYNET project is based on empirical evidence from eight European Mega-City Regions (MCR) with a polycentric structure, defined as “a series of anything between 10 and 50 cities and towns physically separate but functionally networked, clustered around one or more larger cities, and drawing enormous economic strength from a new functional division of labour” (Hall and Pain, 2006, p. 3). Nonetheless, this definition, taken from the earlier Eastern Asian MCRs, becomes to some extent inadequate to the case studies (Halbert et al, 2006), where there usually is a lack of connection within secondary nodes (Hall and Pain, 2006).

In fact, these authors stress that polycentricity is a matter of scales, since polycentricity at the national level may imply monocentricity at the regional level in peripheral regions. Indeed, most academic literature focuses on polycentric central regions, and there is little about its effects on peripheral areas. A significant exception is Copus (2001), who in addition to a reviewed definition of peripheral areas and their attributes, points out two weakness for the correct application of the ESPD polycentrism to peripheral areas: on the one hand, it may intensify regional or local polarization; and on the other hand, ‘the absence or weakness of both theoretical foundations and practical policy recommendations’ (p. 548), which clearly agrees with the empirical evidence cited above.

Despite Catalán et al (2008) optimism, relying in polycentricity as a strategy to control the excess of urban dispersion or densification in Mediterranean areas, most authors are less confident since only some of the empirical experiences have succeed, and there is no certainty whether the PUR strategy has actually been a key factor on it. Anyway, the same cited authors agree that polycentric systems are still under development and, in Parr words, ‘[it is] a hypothesis in need of testing’ (Parr, 2004, p. 239).

The need of integrated policies; good transport infrastructures; and institutional cooperation is also commonly cited within the academic literature. It is also cited an advisable analysis of the specific region in which policies will be applied in order to be able to attend its particularities. For this purpose, suggestions from Copus (2001), referred to peripheral indicators, and from Riguelle et al (2007), in relation to spatial pattern measurements at the regional level based on autocorrelation indices, can be applied to add a quantitative perspective to the local knowledge provided by local and regional experts and policy-makers. A more deep quantitative and qualitative analysis on the polycentrism of a region based on advanced product services has been done within the POLYNET project (Hall and Pain, 2006).
To sum up, the following table summarizes the main advantages and disadvantages of the three strategies. Although some real examples of these models have been exposed by different authors, most urban areas are hybrid. Particularly in Spain, cities have a tradition of compact development that has recently spread to the surroundings. In Northwest Spain the sprawl process has easily merged with the rising of small towns near the cities, leading to a kind of unplanned mixture of the three typologies.

Table 1. Principal characteristics of the dispersed city, the compact city and PUR

<table>
<thead>
<tr>
<th></th>
<th>Dispersed city</th>
<th>Compact city</th>
<th>Polycentric system</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advantages</strong></td>
<td>Social - Residential use is isolated from hazard uses</td>
<td>Environmental and Social - Reduced need to travel by car and enforced public transport</td>
<td>Social, economic and environmental - Problems of excess dispersion or densification can be avoided</td>
</tr>
<tr>
<td></td>
<td>Social - More space per housing unit</td>
<td>Social - Improved social cohesion and accessibility to facilities and services</td>
<td>Social - Reduced spatial and social polarization</td>
</tr>
<tr>
<td></td>
<td>Social - Quick access to open spaces</td>
<td>Economic and Environmental - Improved efficiency of the infrastructural network and reduced use of land</td>
<td>Social, economic and environmental - medium-sized cities are favoured without a need to grow in size</td>
</tr>
<tr>
<td><strong>Disadvantages</strong></td>
<td>Environmental and Economic - Increase of land use consumption</td>
<td>Environmental and Economic - Over-densification leads to congestion</td>
<td>Economic - Small-scale infrastructure facilities</td>
</tr>
<tr>
<td>Social - Reduced accessibility to facilities and services</td>
<td>Social - Shortage of open space near to residential areas</td>
<td>Institutional - Cooperation difficult to achieve</td>
<td></td>
</tr>
<tr>
<td>Social and Environmental - Car-dependant, which leads to pollution and congestion</td>
<td>Social and Economic - It has not reached the supposed objectives in employment, energy and transportation</td>
<td>Economic - It has more transport needs than the compact city</td>
<td></td>
</tr>
</tbody>
</table>

Source: Personal compilation based on literature review.

The following figure shows the physical appearance and interactions between these three spatial patterns. The city centre of Gijón (Spain) has a compact layout whereas recent urban development has spread towards the east of the city in a low density and single use form. The whole city is one of the nodes in the urban structure of the central part of Asturias, where there also are a similar-sized city (Oviedo), a smaller one (Avilés) and some small villages connected through the road system (only localities over 10,000 inhabitants are drawn).
1.2. The Northwest Spanish Region

The study area comprises the three peripheral autonomous regions of northwest Spain, which are Galicia, Asturias and Cantabria. This coastal region covers about 45,000 sq km from the Iberian Peninsula very northwest to the limit with the Basque country. Although the Basque country shares its main geographic characteristics with this area, it has not been included in the study because it is not a peripheral area at all, but it is one of the most important economic areas of Spain.
1. Physical characteristics and transport infrastructure disposal

The Northwest region of Spain has a peculiar orography in which the mountains and the sea are very close together. It can be considered a mountainous region as a whole; in fact mountains have a significant role in the settlement and infrastructure disposal.

The Cantabrian Mountains cover the middle and southern part of the region, being an obstacle that has limited the access to Castile and thus to Madrid. Although this is the direction of the main economic relationships, the four north-south highway accesses have been developed quite recently, and high speed train connection is still being discussed.

On the contrary, the north strip has better physical conditions and an east-west highway has been built from central Asturias to Bilbao, which is currently being expanded to the west in order to reach La Coruña in Galicia. Furthermore, the Atlantic coast of Galicia is well connected through a north-south highway that is now being linked to the inner motorways that lead to Castile.

Fig. 3. Height map of Northwest Spain

2. Population and settlement pattern

According to the last Census (2001), the population of the whole area is near 4.3 million people. The particular spatial distribution leads to a huge number of settlements that increases to the west. Actually, Galicia on its own has, with over 30,000 settlements, almost a half of the total Spanish amount.

To understand population’s spatial pattern it is important to know the urban hierarchy (see fig. 4 below), where the main cities (over 150,000 inhabitants) are Vigo, La Coruña, Oviedo, Gijón and Santander. Vigo and La Coruña are the larger cities in Galicia, but, according to the rank-size rule, they both have less population than they should have in relation to the overall population of the autonomous region. On the contrary, Oviedo, Gijón and Santander concentrate much more population than it would be expected in a balanced urban network.
There is a group of medium-sized towns (50,000 to 120,000 inhabitants) that form a second level in the urban hierarchy. In Asturias and Cantabria, these cities (Avilés and Torrelavega respectively) are located very close to the main cities described above, forming an area of intense population and activities concentration. On the contrary, in Galicia this set of cities, apart from being more populated, have a more balanced distribution, making the Atlantic corridor more consistent (Ferrol, Santiago de Compostela and Pontevedra) and structuring the interior (Lugo and Orense). Together with the main cities, they sum over 40 per cent of the population.

The third level of this hierarchy consists of several towns located mainly near the coast, and more dispersed in Galicia, where they are more frequent and play a much more significant role. Finally, 16 per cent of the population lives in clearly rural areas (municipalities with less than 5,000 inhabitants).

Table 2 below demonstrates the dominance of Gijón and Oviedo in Asturias, and Santander in Cantabria, opposite to the role of Vigo and La Coruña in Galicia. In Galicia, only around 20 per cent of the population and working force live in the largest cities, with a slightly increasing trend. Asturias shows a higher increasing rate of concentration in Gijón and Oviedo (around 45 per cent), whereas Santander, with 33 per cent of the population and working force, shows a decreasing rate in favour of the surrounding municipalities.

To summarize, the main issues to highlight are, on the one hand, that Galicia has two weak main cities and a relative strong group of towns. On the other hand, Asturias and Cantabria present a concentrated urban area around the north-central sector of each autonomous region, and a lack of towns able to properly structure the rest of the territory. It must be also said that the city of Bilbao, which is out of this region, extends its influence over the eastern part of Cantabria.

The spatial pattern of this area is the consequence of the traditional hybrid development between the compact city and small settlements, mixed with a recent and increasing sprawl development.

Table 2. Dominance of cities over 150,000 inhabitants in relation to their respective Autonomous Region. Northwest Spain, 1981-2001

<table>
<thead>
<tr>
<th>Cities over 150,000 inh.</th>
<th>A. Region</th>
<th>Resident population</th>
<th>Working resident population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Persons</td>
<td>%</td>
<td>Persons</td>
</tr>
<tr>
<td>Vigo</td>
<td>261,331</td>
<td>9.29</td>
<td>280,186</td>
</tr>
<tr>
<td>La Coruña</td>
<td>231,721</td>
<td>8.24</td>
<td>236,379</td>
</tr>
<tr>
<td>Gijón</td>
<td>256,433</td>
<td>22.70</td>
<td>266,419</td>
</tr>
<tr>
<td>Oviedo</td>
<td>184,473</td>
<td>16.33</td>
<td>201,154</td>
</tr>
<tr>
<td>Santander</td>
<td>179,694</td>
<td>35.02</td>
<td>180,717</td>
</tr>
</tbody>
</table>

Fig. 4. Northwest Spain settlement hierarchy, 2005

Source: Personal compilation from IGN, IDEE and INE.
3. Economic activities

In the last decades there have been considerable changes in the economic base of the Northwest region, but not on its general spatial pattern, where there has been a process of increased concentration near the coast in the form of urban fringe development.

Although currently the whole region shares a strong service based structure with the rest of Spain and western countries, it is important to give a short explanation of the different ways each autonomous region has reached this situation.

Galicia has based its economy on agriculture and fishing activities until very advanced the 20th century: in 1981 40 per cent on average of the working force was dedicated to the primary sector, with values over 60 per cent in the provinces of Lugo and Orense (INE, 1981). The industrial process came later and softer than in the rest of the northwest region, and the industrial crisis affected more severely to the fishing activities. Whereas Santiago de Compostela is a clearly service-oriented city, Vigo, La Coruña and Orense share their service role with some industrial activities.

The situation in Asturias and Cantabria is more similar to each other. They were highly industrialised in the 20th century, the former mining based and the latter more related to chemistry and steel activities, and they really suffered the oil crisis’s effects in the eighties. The spatial distribution of these industries concerns mainly the central sector of Asturias and the central and eastern Cantabrian coast. This is where road investment has been concentrated in the last two decades, connecting these areas internally and to the south towards Madrid.

Nowadays, the gap between the more developed areas, (the Atlantic corridor, central Asturias, and central and east Cantabrian coast) and the rest of the region has increased, since these areas concentrate more population, economic activities and health and education services than they did 30 years ago. Taking into account that their regional governments are elaborating their respective spatial strategies documents, another spatial strategy should be suggested in order to get a more balanced territory according to sustainable criteria. Obviously, the transport network plays a central role when trying to enhance a spatial pattern.

2. Criteria, integrated policies and institutional issues

2.1. What strategy would be more suitable for a peripheral area?

We have seen that each spatial strategy (dispersed, compact or network) has its pros and cons. The literature review summarized in the first section allows the characterization of some elements whose combination can be used as a criterion to choose the most suitable spatial strategy. Nevertheless, great efforts on applying integrated policies adapted to the regional and local circumstances must be done to succeed.

The following paragraphs describe four essential components of the different spatial impact derived from spatial strategies. Considered as wide notions, they have been
chosen because they synthesize the variety of impacts derived from a specific spatial strategy. As it has been said, real cities are hybrids that show these effects partially.

*Resource efficiency*: land, energy and infrastructure efficiency deals with environmental issues, from the resources consumption viewpoint, and with the economic aspect, due to the different cost that each system have on families and firms' budget. A dispersed city implies a larger quantity of urban land, which inevitably leads to more transport needs and energy consumption. A more compact scheme reduces the quantity of urban land and, to some extent, families' need to travel. In addition, it favours public and alternative transport, but it does not have such an effect on goods and energy transportation. Up to now, residential market preferences go in the dispersed direction, but compactness and mixed uses is related to dynamism in the city centre and agglomeration economies. Polycentrism has the potential to develop an efficient transport infrastructure (road and public transport), thus increasing accessibility due to lower congestion rates. Besides, landscape fragmentation is a significant impact on the environment that increases with the decrease of land use mixture.

*Health*: high car-dependant and long journeys requiring spatial structures have effects on the environment and human health. Pollution, noise and fatal accidents affect humans and animals. Reducing the need to travel and new technologies will alleviate these problems, and there is some evidence that shorter and slower journeys also have a positive effect. However, excessive compactness leads again to congestion, thus pollution, noise, accidents and it also limits access to open space.

*Cohesion*: sustainable development also means a balanced distribution of social and spatial benefits and detriments. Peripheral areas, and specifically Northwest Spain, are characterised by an increasing gap between ‘dynamic’ and ‘regressive’ areas. The compact city focuses all the attention on the main urban area (the dynamic point in the peripheral region), leaving unattended the rest of the territory. The dispersed city favours the urban development of the most accessible areas to the main city, but with high land consumption, car dependency and environmental cost. The network city encourages the development on existing compact population centres, hence ideally combining social and environmental criteria.

*Achievability*: this has to do with the sometimes underestimated institutional and cultural factors. Against the ideal perspective shown above, empirical evidence reveals great difficulties in achieving a network system at the local or regional level. Long term multi-level and sectoral institutional cooperation is required, and in the meanwhile the dispersed city fulfils individual preferences related to housing and car ownership.

According to the characteristics of Northwest Spain, where spatial imbalance is rising and there are, with differences, a large set of settlements, it seems worthy to test a spatial strategy leading to a network of medium-sized, at this region's scale, urban centres based on high-quality connections and a considerable improvement of public transport. The ESPON project 1.4.1, titled “Small and Medium Sized Towns (SMESTOs)”, supports the significance of this kind of settlements to avoid polarization and encourages, where possible, polycentric development (ESPON, 2006a).

However, a polycentric system can be, as described by Brabec and Lewis (2002, p. 491) either a set of compact cities linked by transport infrastructures forming a functional unit; or a series of core areas within a sprawl environment. Thus, great emphasis should be invested to achieve the former option. Actually, POLYNET conclusions show how polycentric-like structures in dynamic and metropolitan areas has led to increasing cross-commuting, has undermined the critical mass needed for
some kinds of business, and has favoured some kind of urban sprawl related to improved transport infrastructures (Hall and Pain, 2006).

Although the POLYNET study is based on a high qualification activity such as Advanced Producer Services and does not analyses peripheral areas but central metropolitan areas, its call for concentration and monocentricity should not be underestimated. Furthermore, ten years before Nijkamp et al (1996) had arrived to the same conclusion although it has to be said that they were comparing just spatial dispersion versus concentration. Conversely, within the results of the TRANSPLUS project (related to land use and transport integrated policies) Macario et al (2005, p. 356) recommend monocentricity on small cities and polycentricity on larger cities, arguing that polycentricity can limit sprawl, and Sessa (2007) highlights polycentric structures as preferred to monocentric. Banister (2007a and 2007b) also relies on polycentric systems to improve sustainability. Besides, Skovbro (2002), after analysing Oesterbro district in Copenhagen, alerts about the negative effects of the compact city in the local scale.

Within this debate, the clearest idea is that in order to improve sustainability, sprawl or the dispersed city should be avoided, but empirical evidence disagrees on the most suitable strategy. The regional perspective may bring some light to this issue, since sprawl “by definition, includes land area other than the traditional urban core” (Brabec and Lewis, 2002, p. 487). In concordance with the regional characteristics of Northwest Spain, a regional polycentric strategy can be approached through a network of monocentric towns. This ‘not equal but more equitable’ strategy is seen by Baudelle and Guy (2004, p. 8) as the necessary scenario for peripheral areas in Western Europe. ESPON project 1.1.1 (Potentials for Polycentric Development in Europe) highlights the strengthening power of polycentricity if applied at all the scales, and, particularly at the regional level, it underlines the need for structural fund regulations.

In the next sections we will see the role of land use and transport integrated policies (LUT) into improving spatial and transport sustainability and the implications for the institutions.

2.2. Land use and transport policies and their integration

Wegener (2007) states that integrated policies are the most effective ones to get sustainable cities, since they make it possible to solve conflicts between individual policies in order to find a balance between the increasing mobility of people and the environmental requirement of reducing the need to travel. If this is true for urban planning, it makes even more sense when applied to the regional level, where multiple level and sector policies concur. Accordingly, Shiftan et al (2003) carried out a scenario development process based on the Delphi method in which the desired scenario includes the encouragement of using a high quality public transport through land use measures. Obviously, larger policy integration will be welcomed and will improve the results.

According to Macario et al (2005), LUT policies can improve the economic, social and environmental dimensions of sustainability through measures trend setting to reduce the need to travel, specially by car; land consumption; polarization, without undermine economic growth; and transaction costs. Correspondingly, in Priemus words (2007, p. 680), “the transport networks contribute the most to the structure of spatial development”, and Banister (2007b) states that these underestimated policies should be combined with technology, regulation, pricing and information measures.
The following proposal of LUT measures is based on Banister (2007a and 2007b) and
the conclusions of some of the Land Use and Transport Research projects. Concretely,
the PROPOLIS, SCATTER and TRANSPLUS projects have been selected because of
their focus on integrated policies and institutional issues (Wegener, 2007).

Macario et al (2005) and Sessa (2007) set the main guidelines that adequate LUT
policies should follow according with the TRANSPLUS project:
- Public transport oriented development
- Intensification and mix of uses in urban areas to encourage short distance
  journeys that could be made walking or cycling
- Car restriction oriented development with “pull and push” measures.

Sessa (2007) includes specialisation of the different centres, but according to the
POLYNET results (Hall and Pain, 2006), this may increase the need to travel and
encourage criss-cross commuting, which is difficult to support by public transport. For
this reason, and according to the scale and settlement size of Northwest Spain (which
could be taken as a prototype of peripheral area), concentration of advanced activities
(occasionally used by main citizens) in the larger city should be combined with multi-
functional daily and weekly activities and facilities in medium and small towns.

The set of possible transport, land use and technology measures to combine, at
different levels, suggested by Banister (2007a and 2007b) is summarized in the
following table:

Table 2. Measures to combine in LUTs

<table>
<thead>
<tr>
<th>Land use</th>
<th>Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The location of new mixed development within urban areas from 25,000 to 50,000 inhabitants with medium densities near to high accessibility nodes or corridors</td>
<td>- Road pricing</td>
</tr>
<tr>
<td>- City design at the personal scale and considering recentrification</td>
<td>- The increasing of fuel taxes according to inflation</td>
</tr>
<tr>
<td>- Establishing size thresholds for the availability of services and facilities</td>
<td>- Cordon pricing</td>
</tr>
<tr>
<td>- Creative use of the street to occupy the released space</td>
<td>- Bus Rapid Transit Systems</td>
</tr>
<tr>
<td>- Public transport-oriented development and transport development areas</td>
<td>- Demand management</td>
</tr>
<tr>
<td>- Car-free development</td>
<td>- The efficient use of transport: high passenger occupancy and load in freight transport</td>
</tr>
<tr>
<td>- The introduction of standards and measures related to noise and emissions</td>
<td>- Promotion of walking and cycling</td>
</tr>
<tr>
<td>-</td>
<td>- Car parking restriction</td>
</tr>
<tr>
<td>-</td>
<td>- City road policies (pedestrianisation, lowering speed limits, travel plans, cycle and bus lanes, etc.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technology</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The production, marketing and tax reduction of ‘green cars’</td>
<td>- Interactive and participatory process with involvement of all parties and stakeholders</td>
</tr>
<tr>
<td>- Improving biofuels</td>
<td>- Information and publicity to the citizens</td>
</tr>
<tr>
<td>- The use of best available technologies</td>
<td></td>
</tr>
<tr>
<td>- To spread use of telecommunications: home/remote working; e-commerce; mobile technology</td>
<td></td>
</tr>
</tbody>
</table>

Source: Compilation from Banister (2007 a) and Banister (2007 b).

Some of these measures can be combined in the same area, others can be
implemented in some parts of the city, such as free car development, and others do
require to be combined, such as impact fees and public transport investment.
Technology is needed to improve the transport system and information is needed to
improve the use of it. Moreover, the use of telecommunications have and increasing impact that should be studied in relation to land uses, congestion, travel to work, etc.

The analysis made within the SCATTER and PROPOLIS projects (Gayda and Lautso, 2007 and Lautso and Wegener, 2007 respectively) indicates that best results would be achieved through the following combination:

- Car pricing policies (increase the use of the car by 50 per cent per km.)
- Improvement of public transport: reduction of fares (only in the central agglomeration); speed increase and service improvement (frequency and quality)
- Promotion of mixed use development near public transport stations: tax on offices not located in well public transport served areas
- Land use control in the outer suburbs: impact fee on suburban residential development.

Cordon pricing and parking policies were removed from the SCATTER project because they may imply a repulsive effect on employment, especially the latter. However, there is not an academic agreement; in fact, some authors deny any kind of relationship (Wegener, 2007). In consequence, these measures should be time and space adapted (Lautso and Wegener, 2007).

Focusing on land-use measures related to transport infrastructure, the guide published by the UK Department for Transport (DFT, 2006) generally agrees with the measures shown above, adding some notes related to transport issues:

- Locations where it is likely to generate high volume person movements close to the junctions of the strategic highway network should be avoided
- Development of high quality interchange facilities between all modes should be priority
- Maximum levels of parking provision should be established for non-residential developments, to encourage the use of an improved public transport
- The use of public transport in areas of high tourist demand should be maximised
- Transport services for sectors and areas with low accessibility are a priority.

According to the evidence and academic suggestions, attention should be paid to the process shown on figure 5 below. The provision of quick, frequent, interconnected and cheap public transport together with a significant increase of costs associated to car ownership and use, and the promotion of mixed use areas will reduce the need to travel, thus there would be less congestion. Less congestion means a reduction in the time needed to make a journey, which in turn can lead to an increase in the distance travelled. Restrictions to land development outside central locations should be done in order to follow the ‘green path’ of the scheme.

Limitation and concentration of developable land to a central area will limit the consumption of resources, but it may eventually raise land cost and congestion, pollution and perhaps increasing social segregation. Within a strong framework of vertical and horizontal institutional co-operation, and an appropriate communication to citizens and stakeholders, making them participate, a network of urban centres may alleviate land costs and congestion minimising environmental damage, consumption of resources and social segregation.
However, it is necessary to keep one’s feet on the ground and look at some empirical evidence about regional scale planning: Goodchild and Hickman (2006) warn about the difficulty of succeeding regional strategies, and also did Priemus and Zonneveld (2004), who despite of that draw attention to the need to move through scales.

2.3. The indispensable institutional co-operation

The need for institutional co-operation and coordination and the difficulty of achieving it are commonly known. The ESPON project 2.1.1 (2005) synthesises the main horizontal drawbacks identified in the application of EU Transport and TEN policies, which in general terms can be reasoned to the regional scale. Major horizontal issues have to do with the misunderstanding of the relationships between transport and spatial and other policies, the large amount of budget required by transport policies and the confusing link between reducing transport costs and making users aware of real transport cost.

The main difficulty of vertical co-operation is usually caused by a lack of consensus about the path to follow, which derives in individual competition. ‘Vertical as well as horizontal conflicts may appear whenever either of the different interest dominates the others’ (ESPON, 2005 c, p. 38).

The importance of the necessary transport and spatial planning at the regional level, and the obstacles derived of the lack of it, is demonstrated in a report prepared for the Department for Transport (UK) titled The Integration of Regional Transport Strategies with Spatial Planning Policies (DFT, 2004). The study is based on interviews and workshops with regional planning participants, who highlight that there are both internal and external barriers to spatial and transport strategies integration. Internal barriers

Source: own elaboration.
focus on big projects rather than getting the best out of the existing and failing to connect road and rail issues are the most remarkable. External constraints are, among others, lack of coordination between the local, regional and national level, over attention to multi-modal studies in detriment of LUT strategies and weak integration of LUT policies at the local level. Besides, the different methodological approach of transport and land use planning leads to out-of-time requirements of accessibility data by spatial planners, and of land use information by transport planners.

Knaap et al (2006, p. 145-146) have some recommendations to the role that regional governments should play, being the most remarkable: enhancing the relationship between regional discourses; improving the regional organizing capacity; the formulation of strategies to ‘make optimal use of the region’s potential synergies’ and providing a more stable environment for trans-municipal co-operation. Furthermore, the national state should participate focusing on how to connect the region to trans-regional networks.

The DFT (2004) report confirms that across programs should be integrated through the collaboration between different administrations, and it suggests partnerships, to choose the degree of formality, as a way to implement this integration. Adequate technical resources and public participation are also essential. This report is followed by a formal guide to integrate Regional Transport Strategies in Regional Spatial Strategies (DFT, 2006) producing a single document for integrated spatial and transport policies.

In relation co-operation through partnerships, lesson can be learnt from the Berlin-Brandenburg region experienced dealing with decentralised concentration objectives. Arndt et al (2000) review the path of institutional co-operation followed by this region from the Urban Forum (where state and local authorities share valuable information and negotiate policies) to a more complex organization in which a General Assembly and Workgroups are the main actors. From this experience, the above mentioned authors point out the importance of a combination of ‘top-down’ and ‘bottom-up’ approaches and the strengthening power of local co-operation in vertical negotiations. They also denote the importance, and recognize the difficulty, of concreting the objectives at the local level.

The full integration of these strategies implies that the transport strategy should take into account the key themes of the spatial strategy, and that the spatial strategy should fully appreciate transport concerns. Furthermore, institutional co-operation and coordination would be favoured if, after analysing the regional background, the following principles to policy-design are applied:

- ‘Include a clear and reasoned justification for the policies;
- Add value to national policy and guidance;
- Set out regionally specific policies that distinguish between different parts of the region;
- Provide a clear policy framework for cross-boundary work between local authorities.’ (DFT, 2006, p.10).

ESPON project 2.1.1 (2005) deals with the specific situation of peripheral areas focusing on trade-offs between spatial equity, economic efficiency, and environmental sustainability with the objective of minimising anti-cohesion risk and environmental externalities. On the one hand, in order to deal with economic efficiency and spatial equity, the report suggests systematic monitoring of the benefits generated by new infrastructures and the development of the secondary network to favour the growth spread to peripheral areas. On the other hand, they suggest the application of pricing
policies with compensation funds to the loser areas to increase transport cost, thus reducing the overall amount of travel.

Because of the difficulty of institutional co-operation, a detailed assessment should be done when concreting policies and measures to apply. For this purpose, some qualitative experiences based on the Delphi method (Shiftan et al, 2003) or gaming and scenario building with stakeholders participation (Mayer et al, 2004) have been suggested. Particularly; best results from the Delphi method would be achieved combining experts from different disciplines and with local knowledge; well defined questionnaire and scenarios; several rounds; and deep analysis of the answers. On the other hand, gaming activities with different scenarios and the participation of regional and local authorities, stakeholders, citizen’s associations, etc. lead to a better understanding of each other’s perspective, which can be of great help to create more suitable policies for everyone, as well as easing its acceptance.

More recently, ESPON project 3.2 (ESPON, 2006b) suggests a multicriteria methodology, named TEQUILA, that, with a quantitative and qualitative perspective, assesses the territorial impact of policies previously to their implementation at the EU and regional level. Copus (2001) and Riguelle (2007) contributions should be taken into account within the quantitative perspective.

Lennert (2007) alerts that this methodology guide, which in fact can be applied in many forms, has to be taken as an appraisal to what it may happen, given that policies are applied in the real world, where no control group can be analysed and where interrelationships hinder measuring the exact policy effect being the rest constant. For these reasons, policy assessment can anticipate possible side effects and avoid incoherencies within policies, but cannot give a quantitative measure of the effects.

This point of view seems to contrast with the vast literature available related to land use and land-use and transport models that simulate the effects of policies. These quantitative methods forecast policy results through the integration of policy packages; GIS databases; and land use and transport models. Nonetheless, researches that have applied these methods usually admit that their results cannot be easily extrapolated to other regions and also a shortage in the measurement of some components that should be further investigated. Despite of that, they are a majestic tool for scenario building.

Accordingly, it seems reasonable to suggest the ESPON perspective as a starting point, which takes into account decision makers priority objectives and desirable impacts. The application of the TEQUILA method will provide politicians with a rational view of the territorial implications and relationships of the policies in advance to their application, which may help to decide the best policy combination. Efforts should be also invested in public participation and information, whose effects have probably been underestimated.

2.4. Recommendations for Northwest Spain

1. Current Regional spatial strategies under development

To date, Galicia and Asturias have elaborated proposals of their respective documents about regional spatial strategies (Xunta de Galicia, 2008; Gobierno del Principado de Asturias, 2006), whereas Cantabria will start the preparation of its correspondent document soon.
According to the above mentioned documents, both Galicia and Asturias autonomous regions rely on enhancing a polycentric urban structure encouraging the development of medium sized villages to strength spatial equity. Both proposals focus on compact development, transport infrastructures and public transport improvement as a means to achieve a balanced urban structure, and they also plan special plans for their respective metropolitan areas. It is recognized that institutional co-operation and public participation is needed, and these regional scale documents assume the challenge.

However, they differ in the functional perspective of the polycentric system. Whereas Asturias banks on the encouragement of mixed urban areas avoiding excessive specialization; Galicia promotes functional specialization of complementary cities and the development of exclusive industrial or service areas linked to transport infrastructure and public transport oriented.

Both documents include land use and transport strategies and recommendations, but, apart from the idea of setting new development near to public transport infrastructures, there are no integrated land use measures; and with the exception of compact and mixed land use development, there is nothing said about reducing the need to travel.

These documents, that include an extensive report about the regional spatial structure, are on a proposal stage, thus there is time to make some modifications according to the ideas expressed in the previous section, and they can be taken into account in the development of concrete measures.

2. Suggestions to improve regional spatial strategies

Dealing with horizontal and vertical institutional co-operation and citizens and stakeholders participation is a difficult task. Arndt et al (2000) have studied the organisational structured of the Urban Forum in Berlin metropolitan area, and through its evolution some lessons can be learnt from the drawbacks they found: ‘top-up’ and ‘bottom-down’ approaches should be combined within an elected body in charge of making decisions from projects groups suggestions.

According to the Spanish distribution of competences between the national, regional and local authorities, the diagram on figure 6 shows an adaptation of Arndt et al's structure (2000 p. 1915). The regional government would be the sponsor entity; since in Spain the state has no competences on spatial planning. The elected assembly would be constituted from responsible persons from the municipalities, regional government (mainly spatial management, transport and environment departments) and the National responsible persons at each region for transport, housing and the environment. This assembly will choose a spokesperson and a steering group that will “give work” to different project groups in charge of researching and suggesting solutions. These projects groups may include experts, technical consultants, partnerships with stakeholders and citizen’s associations, professional associations, etc.
Accordingly with the objectives of sustainability, reducing pollution; increasing social and spatial equity; and favour economic development, the following table summarizes some recommendations that can be implemented by regional governments. In addition, the impact of technology improvements related to vehicles, transport management systems and telecommunications should be studied and taken into account in the policy making. Further research would be needed in each particular region to implement specific measures attending at their peculiarities.
### Table 3. General recommendations at the regional level and adaptation to Northwest Spain

<table>
<thead>
<tr>
<th>Policy / objectives</th>
<th>General recommendations</th>
<th>Specific objective</th>
<th>Constraints and advantages</th>
<th>Recommendations to Northwest Spain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Public transport improvement</strong></td>
<td>The number of stops or stations should be high enough in the central areas to encourage modal shift and door-to-door travel and they should be separated enough between centres to avoid sprawl. The service should be frequent and high-qualified. Travel offer and demand management, including the coordination of different companies and modes, and new technologies should be applied to achieve it</td>
<td>To increase the use of public transport and to avoid sprawl</td>
<td>Public transport is not coordinated and it is almost inexistent in may areas. Congestion, parking problems and rising fuel prices are helping factors in making people consider the use of public transport</td>
<td>Current bus, coach and rail routes should be coordinated in relation to stops/stations, timetables and tickets. This can be done at the regional level</td>
</tr>
</tbody>
</table>
| **Objectives:**  
- To reduce further sprawl  
- To reduce car-dependency | Fares should be cheap enough to compete with car travel | To reduce the use of the car | Currently regional government set maximum prices per journey that are as expensive as the use of the car individually | Regional governments should agree with companies cheaper fares |
<p>| | Maximise the use of public transport in areas of high tourist demand | To reduce congestion in tourist resorts | Tourism is a quite important activity in Northwest Spain, and encouraging the use of public transport instead of car rental is a good option to alleviate congestion around tourist destinations, which occur specially during the summer, Easter and bank holidays | Public transport linking tourist resorts and airports should be improved, particularly in the mentioned dates |
| | Transport services for sectors and areas with low accessibility are a priority | To improve spatial equity and to reduce the use of the car | Public transport services to small villages is almost inexistent because they do not provide benefits for private companies | Regional governments should support public transport services linking small towns to medium and larger cities |
| <strong>Car and road pricing; and parking restrictions</strong> | Estimations show that car use reduction requires an increase in car cost of at least 50 per cent per km | To reduce emissions, car accidents and congestion | At present there are many areas with almost inexistent access to public transport | Further research is needed |</p>
<table>
<thead>
<tr>
<th>Policy / objectives</th>
<th>General recommendations</th>
<th>Specific objective</th>
<th>Constraints and advantages</th>
<th>Recommendations to Northwest Spain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- To reduce congestion in city centre</td>
<td>To Establish maximum levels of parking provision in non residential areas</td>
<td>To encourage the use of public transport</td>
<td>Current legislation about land use and spatial planning has increased the minimum parking provision for new developments, and there is no maximum level</td>
<td>Revision of land use and spatial planning legislation with proposals from Regional Spatial Strategies</td>
</tr>
<tr>
<td>- To reduce the use of the car</td>
<td>To study the level at which road and parking policies reduce congestion without reducing city centre vitality</td>
<td>To reduce congestion</td>
<td>Larger cities currently have pedestrian roads and parking restriction policies, and medium sized towns are on the debate</td>
<td>To investigate the effect of the currently existing parking and city road policies in large cities, and the way they could be applied in medium towns</td>
</tr>
<tr>
<td><strong>Compact and mixed land use development linked to public transport nodes</strong></td>
<td>Every urban centre should have a mixture of uses so that houses, jobs, daily services and facilities, and public transport are within a walking/cycling distance.</td>
<td>To reduce emissions and car accidents; improve accessibility to services and facilities; and get a more efficient use of land, energy and infrastructures</td>
<td>Cycling is currently a 'forgotten' mean of transport in Northwest Spain. Its renaissance would be a difficult and medium-long term task. However, it would be useful to improve accessibility in urban areas surrounded by several small villages. Cultural heritage and old population are the main obstacles</td>
<td>To provide services, facilities, houses, jobs and public transport nodes within a walking distance To start a long-term plan on information and education about cycling advantages and motorists behaviour to improve cyclists safety</td>
</tr>
<tr>
<td><strong>Objectives:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- To improve accessibility to services and facilities</td>
<td>Development unlinked to centres must be avoided, and taxes/impact fee imposed to developments located far from public transport stations.</td>
<td>To reduce the use of the car</td>
<td>Compact mixed land use development was usual until recent residential sprawl</td>
<td>The encouragement new urban development near public transport nodes can be achieved through the mentioned taxes and fees. New uses should be introduced in residential areas</td>
</tr>
<tr>
<td>- To reduce the need to travel</td>
<td>Locations where it is likely to generate high volume person movements close to the junctions of the strategic highway network should be avoided</td>
<td>To reduce congestion</td>
<td>Some motorway junctions are overdeveloped, but others are new, thus development can be guided to avoid congestion</td>
<td>Further research is needed to avoid over development in strategy motorway junctions</td>
</tr>
<tr>
<td>Policy / objectives</td>
<td>General recommendations</td>
<td>Specific objective</td>
<td>Constraints and advantages</td>
<td>Recommendations to Northwest Spain</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------</td>
<td>--------------------</td>
<td>---------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Institutional co-operation and public information</td>
<td>Horizontal and vertical co-operation, including a clear policy framework for cross-boundary work between local authorities</td>
<td>To learn from other's experience and show the benefits of co-operation</td>
<td>Currently there is a competitive environment within municipalities and regional and there is lack of sectoral coordination at all levels (although this seems easier to achieve)</td>
<td>To create an intermediate body in which authorities of all levels and sectors can share experience and co-operate to achieve their goals (see figure 6)</td>
</tr>
</tbody>
</table>
| Objectives:  
- To improve policies and their understanding, thus their acceptance and application  
- To avoid conflicts between policies  
- To achieve greater benefits through policy combination | Monitoring the spatial distribution of the benefits and the establishment of compensation funds | To measure the impact of the policies so the benefits can be distributed more equitable | Available data is increasing in quantity and quality, with more and more spatial and temporal resolution | This task could be done for one of the project groups (see figure 6). Compensation funds, derived from differences found in the monitoring process, and improvement of the secondary roads network may help to encourage trans-municipal and regional-local co-operation |
| Policies should be clear, justified, coherent with high-level government, and able to distinguish sub-regional particularities. | To facilitate the understanding of policies, thus its implementation | Different parties in different authority levels make a challenge from this | The Regional Spatial Strategy documents that are being currently elaborated are the framework to tackle clear, justified, coherent and spatially adequate policies and to assess co-operation and coordination, as well as setting the basis for public participation |
| Encouragement of citizens and stakeholders participation | To exchange information within institutions, experts, stakeholders and citizens | Public participation is increasing and associations can play a significant role | Associations can take part in policy making participating in project groups (see figure 6) |
| The selection of policies for a specific area should be tested through a qualitative and/or qualitative methodology | To be aware of synergies and conflicts between policies and to prevent unwanted effects | Universities and R+D centres can offer further research for this | According to data availability, a qualitative and quantitative approach based on scenario building and including public participation may be possible |
3. Conclusions and further research

A more compact development is required in order to improve sustainability. Although there is a strong agreement on this statement, the debate between monocentricity and decentralised concentration is still alive. Apart from empiric evidences related to congestion and CO₂ emissions, we have to admit that reducing the need to travel and increasing spatial equity are quite conflictive objectives. In this sense, peripheral areas are ‘lucky’ to have the chance to learn from central and metropolitan areas’ experience.

An important lesson to learn related to LUT policies is that mixed land use developments linked to high quality public transport services are good practices but not enough to reduce car travel. Car pricing policies are also needed to encourage the use of public transport. Peripheral areas, such as Northwest Spain, have the challenge to introduce this ‘pull and push’ measures starting from a basic and uncoordinated public transport system.

Institutional horizontal and vertical co-operation is another key issue that can be facilitated from national and regional governments introducing good practices in the design and implementation of policies. It is important, and difficult, to avoid an excess of competition within local authorities.

Public participation and listening to stakeholders have become essential in the decision-making process. Adequate ways of communication will lead to policies being closer to society’s needs, and at the same time citizens will better understand the need for some (at first sight unpopular) measures.

At present there are controversial studies and empirical evidence about how to achieve a more sustainable pattern of development: more research is needed to take the better of polycentrism (based on mixed compact development) and monocentrism to achieve it.

In addition, further research is needed on how to apply these measures and integrate and encourage public participation in peripheral areas to avoid the known drawbacks experienced by central metropolitan areas. Particularly, more investigation is needed about the regional level.
References


Visited June 2008.


GOBIERNO DEL PRINCIPADO DE ASTURIAS. Avance de la Revisión de las Directrices Regionales de Ordenación del Territorio con Directrices específicas para el Área Central. (Summary review of Town and Country Planning Regional Guidelines with specific guidelines for the Central Zone). 2006, Gobierno del Principado de Asturias. Conserjería de Medio Ambiente, Ordenación del Territorio en Infraestructuras. Available at: http://www.asturias.es/portal/site/Asturias/menuitem.fe57bf7c5fd38046e44f5310bb30a0a0/?vgnextoid=1d43c22bb2940110VgnVCM10000098030a0aRCRD&vgnextchannel=fb70c22bb2940110VgnVCM10000098030a0aRCRD&i18n.http.lang=en. Visited July 2008.


**Sources**

IDEE. *Mapa base del servidor WMS*. Spatial Data Infrastructure of Spain.

IGN. *Base Topográfica Nacional*. National Geographic Institute of Spain.


SITPA-IDEAS. *Cartografía a escala 1:10.000 del Principado de Asturias*. Sistema de Información Territorial del Principado de Asturias.

SITPA-IDEAS. *Ortofotos 1:5.000 del Principado de Asturias*. Sistema de Información Territorial del Principado de Asturias.