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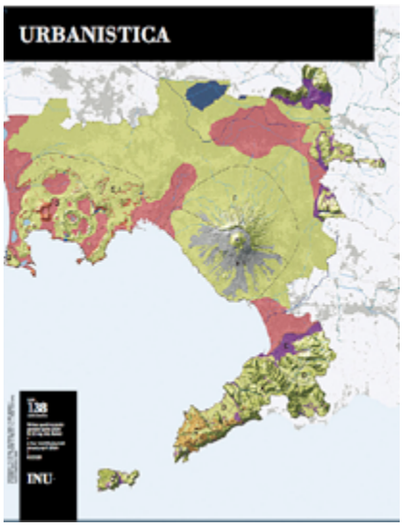

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and english translation
of the articles

Four countries, six experiences, for a single issue: limiting urbanisation

Paolo Pileri

The best known national research on land consumption in Italy is It.Urb '80, which goes back nearly 30 years. Despite this, some of its conclusions are still applicable today: the consumption is more accentuated where the non-residential functions are greater and where the use of urbanised areas is more scarce (which is fairly frequent). But, that experience of research is also remembered for the many difficulties in collating and comparing the data. After all, it was a research conducted without geographic IT systems and with few means of computing.
Unfortunately, after almost 30 years, we are frankly forced to say that what we are mainly left with from that research is the intuition that land consumption is a central issue for planning, but not the progressive transfer of that intuition into the subsequent and successive strategies. And after 30 years, the struggle to find and process data on consumption is almost the same.
Could it perhaps be that limiting urbanisation is no longer a problem? Land consumption is no longer relevant? What is the attitude of other European countries to land consumption?
The recent report, urban sprawl clarifies that the problem exists, is ignored and requires urgent measures for dealing with it (EEA, 2006a).
With the aim of understanding whether, how and for how long other countries have been facing these issues, here are offered seven papers on the policies for limiting urbanisation.
The two concepts common to all the contributions, as in the EEA report of 2006 are: 1) considering land consumption as the transformation of a non-urbanised land cover into an urban one and 2) land is a finite, threatened resource, precious to the environment and to the landscape.

Knowledge about land consumption has disintegrated and needs rebuilding
The availability of data on land consumption is probably the most incontrovertible starting points emerging from the papers.
But in Italy there is no national figures on land consumption, because there is no national database on land usage despite the high number of territorial IT systems. The only data available are those from the project Corine Land Cover (CLC), 1990 and 2000, on the ISPRA site (www.apat.
gov.it). According to the CLC data (see table on p. 82), between 1990 and 2000 in Italy some 83,630 hectares were urbanised (about 23 hectares per day) and 152,612 hectares of agricultural land was transformed (about 42 hectares per day). But it's quite underestimated. From research published recently (Pileri 2008), between 1999 and 2004 in Lombardy, 24,742 hectares of non-urban areas were urbanised (amounting to 13.5 hectares a day). Compared to Germany which consumes 4.7 m2/inhabitant per year (from Siedentop data), Lombardy consumes at a faster rate: 5.45 m2/inhabitant per year. Even ISTAT confirmed that almost 2 millions of hectares of agriculture surfaces disappeared from 1990 to 2000 (ISTAT 2007).
CLC figure has some limitations: the spatial resolution is based on a minimum unit of 25 hectares, surveying changes in 5 hectares over periods of time (EEA 2006b). It is necessary to go beyond Corine, towards a database of higher resolution. In any case, by now Corine is a database that is outdated for supporting today's planning decisions.
The lack of a unified and national geographic database is a serious failing for the county's planning system, a surprising gap that must be filled as early as possible by being equipped to provide municipalities with the tools for their sustainable planning. Guidelines should be provided together with national and inter-regional coordination to avoid confusion and patchy application (Hart and van der Krabber).
Another risk, connected to the lack of databases, is that the intention of putting policies in place for restricting land consumption is hampered. This would be a serious mistake under these circumstances in which municipalities are reworking their plans. Also the Strategic environmental assessment (EC Directive 2001/42, implemented in Italy by Legislative decree no. 152 of 3 april 2006) loses effective capacity in the decision-making and monitoring processes.

The subject of land consumption is firmly on the agendas of public policies
Restricting urban sprawl has been very firmly on the agendas of public policies in Germany, UK, Switzerland and the Netherlands for a long time, and not just as 'grand ideas' but actually being put into practice. And this practice has now accrued into experience. The intended slowing down of urbanisation has not always been attained, but certainly these days in those countries a period of reviewing of the initial policies has begun, while here in Italy the problem remains little more than stated.
In Italy, containing urban sprawl is, perhaps, perceived more as a fringe matter, for specialists, and not seen as central and of interest to the general population, of interest also for public policies and for citizens. Probably the chain of social and environmental effects following on from land consumption, as demonstrated by the Plurel research, is not grasped.
The debate on land consumption in this country is in danger, unfortunately, of merely becoming ideological. Those who broach the subject may even find themselves accused of 'boycotting' economic development and certainly not be seen as someone whois trying apply a new rationale to such land usage, offering other keys

for interpretation and new ways of development (Latouche 2007). Some passages in the accounts by Scholl, Schekte and Nillson show, on the other hand, that an alternative way of thinking is possible and that the affirmation "economic development = building development" can be partially denied. This equation should be corrected, and the corrections should be made known. Unchecked urbanisation, even more so if done in a haphazard way, brings with it costs and debts to the municipality, as well as having effects and impacts on the environment and on health, as has been shown by research even in Italy (Camagni 2002).

The necessary combining of the environment and land consumption issue

In these months of international crisis, Jeremy Rifkin's revolutionary continual proposal is striking. In short, for Rifkin, the solution to the world's crisis cannot just come from economics and finance, but the points of attack on the problem must change: the economic crisis is closely linked to that of the energy crisis and global warming. Innovative solutions will arrive by broadening the outlook to other disciplines and giving preference to a cooperative approach.

The paradigm could also apply to land consumption. As emerges in all the papers, land consumption is included in the environmental issue and is not a subject exclusively relating to planning. Perhaps it is wrong to expect that just from urban planners will arrive the solutions to the problem. Land use and economic interests often short circuit each other. Reaffirming that the question of land use also involves the environment issue, with the respective objectives of strategic interest (biodiversity, capturing CO2, etc.), could open the way to new strategies, increase social awareness of the issue and perhaps rebalance the disparity of power between opponents. The quiet voices of biodiversity must be able to stand up to comparison with the clamour of property development gains, both of which have an interest in the land. Other countries are offering us the strategic key to the environmental interest to overcome urban sprawl, closing circuits that had remained open for too long. Consuming land means consuming nature.

Germany's position is emblematic: ten years ago it amended its building code to reinforce the role of nature in planning: "Give back to nature what is taken from it". This has led to the introducing of ecological compensation, even though, as Siedentop says, this on its own is not sufficient and has not always worked as well as expected. But also these tools are needed for breaking that urban planning routine which often heralds land consumption. Also in the Netherlands, the law on nature protection acts as a brake on urban sprawl.

Adjustments and innovations are needed in our legal instruments. The lesson coming to us is clear: the regulations for protecting nature should have a priority influence and directly make urban expansions responsible.

The return of the 'central' decision maker?

In the 4 countries considered, the decision on the use of the land has been progressively left to local governments. Can a local agency acts in relation to challenges and issues that only partly concern it?

Germany, the Netherlands, Switzerland and the UK maintain a balance between responsibility and freedom of local initiative and the need for regulating at a centralised level. At least three questions arise:

– Land consumption is an issue of national interest given the environmental and social consequences it implies;

– Local governments cannot deal alone with the challenge of limiting urbanisation: they are very dependent on the revenues from urbanisation and they cannot be expected to conceive such strong strategies;

– Progressive local autonomy also in tax and budget matters has often produced an 'estate agency' effect and the municipalities have specialised in attracting new businesses and new inhabitants, meaning new revenues. This deal ought to be modified from national policies.

The Netherlands, Germany, Switzerland and the UK, in different ways, have partially returned the matter of urban limitation to central government: "The local governments can, at most, be given responsibility for implementing strategies for countering urban sprawl, but not for conceiving them" (E. van der Krabben).

Limits to not overstep?

Some countries have chosen to set a nationwide quantity limit for land consumption (e.g. the policy of 30 hectares/day in Germany, or minimum densities in England), while realising that this on its own is not enough. Others have tried imposing geographic limits on urban expansion and not quantity limits (the Netherlands), while others again have set strict non-building conditions (Germany, for the agricultural areas), and others have placed limits for the use of derelict areas (England).

Without doubt, the question of limits should be reviewed and updated, but should not be excluded out of hand, and learning processes among the various carriers of interest are needed. The direction of imposing limits is difficult, but still feasible and often useful for giving a first form of guidance to local governments.

Greenfield versus brownfield.

Caring for open spaces and favouring used areas. In all the cases proposed here, the re-usage of derelict and underused urban areas is a must. This has not been sufficient for avoiding the transformation of greenfields. The devices for reducing the margin of convenience for property developers is still not efficient, and they prefer to transform free areas rather than previously used areas. Germany, the Netherlands, Switzerland and the UK show us how it is necessary to act on two fronts of the problem: each policy for redeveloping previously used areas becomes weak if, at the same time, the possibilities to urbanise greenfields remain active and advantageous.

Towards sustainable land use in Germany: reviewing the German experience with antisprawl policies and tools

Stefan Siedentop

During the 1990's, the continuous land consumption for urban purposes received growing attention in the German urban and environmental planning debate. In 2002, the federal government adopted its first sustainability strategy titled 'Perspectives for Germany' (Bundes regierung 2002). One of the strategy's goals is to reduce the rate of conversion of non-urban to urban land uses from 130 hectares in 2000 to 30 hectares per day in 2020. This so called '30-hectares goal'.

In spite of numerous policy initiatives on the federal and state level, land consumption for urban purposes remains high. As in other developed countries, land use change in Germany can be characterized as a transition of a compact urban form to a more and more dispersed urban land use pattern with moderate or even low urban densities (urban sprawl). Researchers claim that this process increases automobile travel rates, and causes efficiency losses of urban services such as public transport or sewer systems (Schiller/Siedentop 2005). Furthermore, urban sprawl is seen as one crucial contributor to landscape.

There is general agreement on the key drivers of further land consumption

– the increase in households accompanied with further land demand for housing;

– preferences of households for sub-urban or rural living environments;

– the growing use of the private car, supported by relatively low transportation costs and public subsidies for the suburban transportation infrastructure;

– new forms of industrial and service production.

Traditional drivers like population and job growth or motorization are losing their explanatory power. The advanced demographic and economical transition – associated with deindustriali-sation and population decline – leaves many cities with large amounts of underutilised or vacant industrial and residential land. One could assume that Urban shrinkage should discourage urban growth because fewer residents require fewer housing units, less urbanised land and less infrastructure. However, in Germany three major factors work against this logic:

– the ongoing demographic trend towards smaller households, counterbalancing the negative effect of population decline on housing demand;

– the fiscal competition between communities to attract new inhabitants and companies, fuelled by tax regulations and public subsidies for the provision of newly urbanised land for housing as well as for industrial and commercial land uses;

– 'planning routines' of local land use planners that favour greenfield development over brownfield projects, where brownfield development is perceived as more complicated and riskful, and a strong preference for low density housing especially in suburban and rural regions with low land prices.

Even in regions with a significantly negative population balance, the process of land conversion to urban uses doesn't come to rest (Figure 2; see Siedentop/Fina 2008). There is a broad consensus among political stakeholder that an effective anti-sprawl policy covers three general goals, namely:

– the quantitative reduction of land consumption for urban purposes;

– the management of land use pattern in order to preserve an infrastructure-efficient urban form and to protect the open countryside from scatter or leapfrog developments;

– the avoidance, mitigation or compensation of ecological damages caused by urbanization.

However, the debate on how to achieve these goals remains controversial. Many experts argue that a more restrictive 'top-down' regulation of local land use policies is needed. Others claim that the constitutionally protected right of municipalities to decide on their own where and to what extent land is to be made available for building has to be acknowledged.

Germany's 'anti-sprawl armoury'

The national government has very limited power to regulate land use and urban development. Spatial planning itself is exercised by state governments and regional planning authorities (regional planning) as well as by municipalities (local land use planning). Therefore, a considerable variety of planning philosophies and operational performance can be observed among the 16 German states.

From an 'anti-sprawl' perspective, the most important planning policy instruments on the level of states and municipalities are the following (see tab. p. 88):

– Comprehensive development plans on the state and regional level set binding provisions for municipalities and sector planning authorities. The latter refers to the protection of ecologically sensitive areas and the location of new development in central places and near mass transportation. Furthermore, some state and/or regional development plans comprise quantitative caps as maximum values for land conversion from non-urban to urban uses;

– Comprehensive development plans on the municipality level with integrated landscape plans aim to protect environmentally sensitive areas from urban development;

– The Federal nature protection act spells out the obligation of municipalities and sector planning authorities to avoid, mitigate and compensate ecological damages as a result of building and land use change. Based on the experience that negative effects may still persist after mitigation, the law has adopted a compensation principle, envisaged as counterbalancing the impacts of

land use change (to urban uses) on natural assets and landscapes.

Discussion
Germany has been relatively successful in preserving rural landscapes from uncontrolled building activities. Due to the strict prohibition of building in the open countryside ('Außen-bereich'), the problem of scatter developments outside urbanized areas is significantly lower than in many other European countries. A second success story is a comparatively effective protection of environmentally sensitive areas from further urban development. However, it is obvious that instruments of negative planning ('where not to build') are much more effective than 'positive planning' ('where to build', 'how much to build'). The state governments clearly failed in reducing the overall land consumption. Today there is a broad consensus amongst planning experts that the '30-hectares goals' cannot be reached without a massive reform of urban land use practices. Some scholars suggest the implementation of economic instruments in order to implement economic incentives against further sprawl. Proposals range from land use tax regulations with different rates according to ecological damages (Bizer 2000) to tradable development rights between municipalities with a fixed amount of total development for a state or region (Köck et al., 2008). Other scholars prefer 'soft policies' that attempt social learning of stakeholders without legally binding restrictions (e.g. information strategies, voluntary commitments). Arguments in this direction point to the fact of massive opposition of local policy makers against any form of top-down regulation.
Up to now only one point seems to be undisputed – the German debate on effective strategies and instruments towards sustainable land use is an ongoing one.

Urban containment strategies in the Netherlands

Erwin van der Krabben

From the beginning of the nineteenth century, urban containment has always received a lot of attention in Dutch spatial planning debates. As one of the most densely populated countries worldwide, characterized by periods of a fast growing population and strong economic growth, well-thought strategies are indispensable. Since the built-up area still makes up only around 10% of the total surface, it can be argued that urban containment policies have been rather successful. However, in all parts of the country many examples can be found as well of undesired urban sprawl. The core urban containment issues in the present Dutch planning debate concern the preservation of the Randstad Green Heart, discussions with respect to the implementation of growth boundaries, the balance between greenfield and brownfield development (regarding residential and industrial developments) and problems with respect to landscape cluttering.
It is argued that the need to redevelop existing urban areas will define the decisions with respect to urban containment. A strict urban containment strategy, aiming to preserve the 'remaining' open space and even to extend it where possible, must go hand in hand with strategies to facilitate the redevelopment of existing urban areas. Strategies to prevent urban sprawl can only be successful when urban redevelopment is attractive to the property development industry. Since greenfield development is 'by definition' cheaper and easier to implement than brownfield development – property developers (and local governments) tend to find ways to develop at the fringes of existing urban areas. To increase the attractiveness of brownfield redevelopment, spatial planning must create the right conditions. Those conditions include the introduction of planning tools to deal with fragmented ownership situations and financial tools that are necessary to improve the profitability of brownfield redevelopment.

General urban containment principles
The Dictionary of Geography defines 'urban containment' as 'the policy of limiting sprawl by restricting out-of-town development' (Mayhew 1997). The strategies for containment of sprawl are various in their details, but similar in their essence (Millward 2006). Figure on this page, illustrates a variety of strategic options for urban containment, ranging from most restrictive (A) to least (E). Options A and B concern strong bounding strategies. In variant A, only the central city is allowed to expand; in variant B satellite towns may also develop. In both cases, there is strict development control outside the envelopes, of the greenbelt type (Millward 2006: p. 474). Options C and D show, respectively, mo-

derate and weak bounding strategies. The size of the urban envelope is increased, while the development boundary is less strict. In option D, most of the countryside is available for large-lot developments, with only a few key areas (e.g. regional parks) preserved from development (Millward 2006: p. 475). Finally, option E is the do-nothing option: there is no development boundary and urban containment is absent.
In principle, three different strategies with respect to urban containment can be distinguished: the implementation of urban growth boundaries, the implementation of urban service areas and zoning regulations

Urban containment principles in the Netherlands
The urban containment principles can not easily be positioned in the overview of strategic options for urban containment (this page), because of the dynamic character of the Dutch planning regime in the past 60 years (after WWII). In the 1950s, urban containment policies were directed to the implementation of green belts for the large Randstad cities (Type A strategy): it was decided that 'the diameter of cities must not exceed 8 km […]. If existing cities approached this size then new towns would have to be built' (Zonneveld 2007, p. 662). Moreover the Randstad Green Heart concept was introduced. Instead of a green belt surrounding the city, here it was decided to preserve a large open area in between the Randstad cities (Amsterdam, Utrecht, Rotterdam and The Hague) Urban containment strategies in the 1970s are an example of Type B (strong bounding, city with satellites): 'At the start of the 1970s the Dutch government finally decided to establish new towns (…). This became officially known as concentrated deconcentration with the emphasis on concentration (ibid: p. 665). In the 1980s national urban containment policy was again renewed and can now be characterized as a Type C strategy (moderate bounding). Then, urban containment policy in the 1990s returned again to the Type A strategy (strong bounding, compact city). Additionally, large areas were designated, mainly on the edge of existing urban areas for residential developments (the so-called Vinex locations). Since the 1990s, the larger part of all residential development has taken place on these locations.
Finally, in the first decade of the present century, national urban containment policy has followed a rather confusing path. First, the national government decided to implement very strict urban growth boundaries, surrounding all cities (MinVrom 2001). However, after the Dutch Cabinet at that time suddenly resigned in 2002, the new Cabinet soon eased those restrictions (MinVrom 2004). The present government structure is characterized by a strong decentralisation tendency. The national government decided to leave it to the twelve provinces to implement regional urban containment strategies. The result is confusing for many. Very recently, after the installment of again a new Cabinet with a different political color in 2007, it seems that the national government aims somehow to take control again of urban containment policy, by introducing new initiatives to prevent urban sprawl.
Although arbitrarily, it seems that at present the main topics on the national political urban containment agenda concern: (1) the preservation of the Randstad Green Heart; (2) problems with landscape cluttering along motorways, mainly due to the strong growth of greenfield industrial estate developments; and (3) the aim to shift spatial development from greenfield to brownfield (at least 40% of all new developments should take place in the existing urban area). In the next sections, these issues will be discussed in more detail.

Urban sprawl in the Netherlands: facts and figures
The effects of the constant shifts in national urban containment strategies are clearly visible in the patterns of urban sprawl in the Netherlands: current urban sprawl is in fact the result of a mixture of strict urban growth boundary principles and periods of less-strict policies.
The Netherlands is the most densely populated country in Europe. Together with Belgium is the Netherlands, on top, regarding the space that is in use for residential and economic functions (around 10% of the total surface).
The Netherlands belongs at the same time to the countries with the highest amount of space in use for agriculture (around 65% of the total surface).
The fact that the Netherlands is the most densely populated country of the EU does not necessarily result into densely built areas. International differences with respect to the use of space per habitant are mainly the result of differences in planning regimes. The average m2 of built area in use per inhabitant – is lowest in Spain, Portugal and Greece (100-150 m2 per inhabitant) and highest in Belgium, Lithuania and Hungary (500–550 m2 per inhabitant). The built environment in the Netherlands (163 m2 per inhabitant) is, relatively compressed. The area in use for industrial and residential functions has increased substantially in this period (respectively 12.9% and 8.0%), compared to the area in use for other functions.
The space in use per inhabitant varies enormously by region (fig. p. 93) in cities like. The Hague, inhabitants have an average of less than 200 m2 space to their disposal, while in some other, smaller municipalities inhabitant have an average of more than 30,000 m2 space to their disposal.
The Dutch average in 2000 was 2,100 m2 per inhabitant; a reduction of 300 m2 since 1980.
The preservation of the Randstad Holland Green Heart has been one of the most significant topics of urban containment policies. Though building construction in the Green Heart has been restricted since the 1950s, the original Green Heart area has by no means been preserved. Both the boundaries of the Green Heart have been shifted inwards and developments have taken place along the main infrastructure in the Green Heart. Between 1958 (the start from the Green Heart policy) and 2000 the Green Heart total area has been reduced

with 25%. The built-up area in the Randstad Green Heart in 2000 was more than four times larger than in 1958. The development of the built-up area was, until the mid-1990s, took place at an even greater pace than in other parts of the country. Open space in the Green Heart is today a relative concept as it is very fragmented, despite continuous attempts to protect the open spaces (fig. p. 92). One of the developments that must be held guilty for this fragmentation process is the development of industrial estates. (fig. p. 92). The increase of industrial estates in the Green Heart between 1996 and 2002 has been substantially lower than in other parts of the Randstad and in the Netherlands as a whole.
Finally, figure p. 93 shows the greenfield residential developments (the so-called Vinex locations) between 1995 and 2020 in and close to the Green Heart. Each of the locations in figure p. 93 will, after completion, consist of 5,000 to sometimes even 25,000 new houses (mainly single family).
Recently, problems with landscape cluttering along motorways have started to dominate. The surface that is in use for economic functions has increased in the Netherlands between 1993 and 2000 with 15%, while it has been 40 to 60% along the motorways (fig. on this page). The problems with respect to landscape cluttering are, finally, confirmed by an overview of all development plans, mainly for economic functions. It is expected that the implementation of these development plans will further increase the problems with landscape cluttering, despite recent initiatives to reduce this.
Though in the past twenty years total population growth in the Netherlands has been relatively low, urban sprawl has continued to take place. This is mainly due to residential, economic and infrastructure development. The strong demand for new housing on greenfield locations has been particularly fuelled by the continuous reduction of average household size and the Dutch tradition to build mainly single family housing. Strong national economic growth figures, particularly in the 1990s, must be held responsible for the increase of the surface of land that is in use for economic functions. This development has been supported by local government industrial land policies. Local governments in the Netherlands compete each other to attract new companies by incessantly developing new industrial estates. The consequence of this policy is that in many regions industrial land is available in abundance on greenfield locations, resulting in low industrial land prices. In this situation, companies can relatively easily move from existing industrial estates to new industrial estates at the urban fringe. Finally, the strong increase of (car) mobility must also be held responsible for urban sprawl.

Conditions for a successful urban containment strategy?
Moreover in the Netherlands, changes in political color of the national government seem to have played an important role as well, particularly in the last decade. This paper argues that in the next decades a new driving force must be added, namely the need to improve and redevelop existing urban areas. Future building construction will increasingly concern the replacement of existing properties that do not meet anymore with the demands of households and companies. This strategy is, from a spatial planning point of view, clearly the most desirable strategy. However, it is probably also the most difficult way to proceed, mainly because of two reasons: (1) brownfield redevelopment is, from a financial perspective, less attractive to the property development industry than greenfield redevelopment; and (2) brownfield redevelopment is often much more complicated to achieve, because of the fragmented land and property ownership fragmentation.

Starting points
A number of (general) starting points can be defined that are relevant to urban containment strategies:
1) Many studies have shown that strict urban growth boundaries lead to increasing land and property prices (see for an overview: Dawkins and Nelson 2002). To prevent unacceptable increases of, for instance, house prices, urban containment strategies must aim to make sufficient amounts of land available within the growth boundaries.
2) Strict urban growth boundaries will reduce the possibilities to build on green field locations and, at the same time, will put more pressure on the (re)development of the existing urban areas (depending on the amount of development land that is still available between the urban fringe and the growth boundary).
3) Urban containment will always involve a certain tension between the collective interest and the interest of individuals. Policy makers should take account of this tension.
4) When urban containment policies allow increased greenfield development, outside the existing urban area, this will probably add to the 'ageing' of property in existing urban areas. Relatively cheap development opportunities on greenfield locations will attract households and economic activities that used to be located in the existing urban area. Consequently, the demand for the second-handed properties in existing urban areas quite often diminishes.
5) Urban containment strategies by the national, regional or local government is able to define the boundaries to urban development, but do not implement it.
6). Urban containment policy can only be successful when it guarantees the active involvement of the property development industry in the way that fits with the policy objectives.

Conditions for a successful urban containment strategy
Taking the above starting points into consideration, now the conditions for a successful urban containment strategy outlined:
1) National urban containment policy is often strongly influenced by politics. For a successful policy, it is pro-

bably more useful to have a more stable, depoliticized strategy that is able to survive changes in political preferences.
2) One way to achieve this is to involve a certain level of flexibility in urban containment strategies. Instead of implementing strict urban growth boundaries, alternative strategies can be considered as well. More moderate bounding (Type C, figure p. 90), combined with certain minimum percentages of the area that must be left 'open', may offer for example more flexibility to the property development industry to implement new plans.
3) For a successful urban containment strategy, the right government level must be chosen to define this strategy. Usually, this is a choice between national or provincial/ regional government level, depending on, among other things, national planning traditions, the scale on which spatial developments take place and country size. Local governments can be made responsible for the implementation of this strategy, but usually not for defining the strategy (because urban containment usually takes place on a regional level).
4) Urban containment strategies to prevent urban sprawl must go hand-in-hand with strate.

From an economical use of land to land use management strategies, tasks and challenges in Switzerland

Bernd Scholl

Since the city walls were demolished over 150 years ago, the history of European spatial development has been characterised by the increase in land given over to settlements. It is therefore no surprise that the beginnings of modern spatial planning coincided with the emergence of conflicts and negative consequences of the uncoordinated development of settlement areas and the infrastructure associated with urban expansion. In many countries, including Switzerland, legislation reflects a strong concern for the controlled development of settlement areas. In the past, such regulation was largely limited to the organisation of the increase in settlement areas in the context of conflicts of interest. The usual way of dealing with such spatial planning tasks and conflicts was typically to draw on (more) land resources.
This rate of development simply cannot continue, a conclusion also shared by Swiss experts, as no community or polity has unlimited land resources at its disposal.
For Switzerland, therefore, restriction of the settlement area is also a strategic aim of the first order. In a small country with very limited land resources, just under 30% of the total land surface area of 41 000 km2 is suitable for settlement – an economical approach to this non-renewable resource is of central importance.
Nevertheless, one square metre per second is claimed for settlement (8.6 hectares per day). This figure corresponds more or less to the current German consumption of 106 hectares per day. Statistics show that in Switzerland in the mid-nineties approximately 400 m2 of settlement land were used per person, whereas at the end of the 1980s, the figure stood at just under 380 mq. And, as in many other countries, the overall increase in settled areas was no longer directly related to population growth, but mainly driven by higher per capita consumption. The Swiss residential gross floor space of over 50 m2 per inhabitant tops the European ranking.
The issue of restricting settlement areas is therefore not a question of if, but of how, which means that the postulate of an economical approach to land use must be implemented in the form of comprehensive land use management. Of course, this challenging task needs to be evaluated in the light of future requirements in addition to the present strategy for spatial development.
In 2006, the Federal office for spatial development commissioned a group of international experts to report on the state of spatial planning and development in Switzerland. The report, published in 2007, states that Switzerland, "after a half-century of growth is facing a change of substantial significance: The population is barely growing, in many places, it is stagnating or declining - and aging intensively as well. The economy is

changing and has long been moving from an industrial society to a knowledge and research-based society. Agriculture is also changing. The climate change is producing some significant impacts. Sprawl, along with its consequences, is neither economically nor ecologically sensible and narrows the possibilities for action of coming generations. The uneven spatial distribution resulting from the slight increases, stagnation or decline of the population and the increasing percentage of elderly people has led to a shift in demand. The settlements are essentially already built. Growth is so insignificant that cities can hardly be changed structurally anymore. Demands on space are changing. Hence, most of the development must be realised through the transformation of existing areas. This will lead to challenging tasks if we want to further develop our cities and regions".
It will be important to maintain the manageable size and individual appearance of the agglomerations. Bringing the agglomerations into line through overdevelopment threatens the diversity of a manageable area, which is an important value, and through this an important location advantage of the country would get lost in international competition.

Strategic re-development before new development and the Swiss City Network
In Switzerland, the main spatial strategy is to work towards gaining general acceptance for the precedence of re-development over new development. In combination with the Swiss City Network, considerable reserves for settlement have been made available in regions already well served by a highly efficient public transport system. The linking-up of these areas to the comparatively small and medium-sized towns of Switzerland, creates competitive function areas, which are in turn extremely well connected by frequent, high-capacity public transport services. This double strategy of local-oriented settlement development and integration aims to avoid excessive concentration in a few large centres as well as the depopulation of peripheral regions, which would have significant negative consequences and erode the federal structure of the state.
In the 1990s, the larger cities (Zurich, Bern, Basel and Geneva, to name a few) have been in the process of successfully implementing the strategy outlined above by using their local spatial reserves. At the same time, the public transport system is also being expanded. But uneven spatial distribution with low average population densities would run counter to the efficient and economic operation of this system.
These efforts will not be enough, however, to gain nationwide acceptance of the strategy of re-development. Success will depend on bringing on board the vast majority of smaller and medium-sized municipalities and gaining their commitment, for in all probability it is on this level that large reserves for re-development are to be found. Admittedly, there is some concern about the four to five hundred thousand existing buildings that are situated outside a building zone.

Regional land use management. The Space+Initiative
In Switzerland at this time there are around 220.000 hectares designated as building zones and 6.8 million people (93% of the population) live within these zoned areas. According to information from the Federal office for spatial development, 27% or 60,000 hectares of the total have not yet been used. Of these reserves, about half are ready for building. In addition, it is assumed that conversions in the built-up areas will open up considerable reserves. In order to be able to ascertain the actual reserves available for potential re-development, as a prerequisite for regional management, the Canton of Basel Land participated in a special cooperative plan on regional land use management from 2006 to 2008. This plan was initiated by Eth. All 86 communities in the Canton of Basel land and well over 400 in Germany took part in the survey. A total of about 4.450 areas covering about 51.000 hectares were surveyed. Of this total, 750 hectares are in the 86 communities of the Canton of Basel land.
The results will be published at the end of 2008. Certain tendencies for the Canton of Basel land are already foreseeable. Comparing the Space+ survey to the legally required spatial information, shows that about double the number of potential areas could be determined. It must be noted that the legally required spatial information does not include under-used, incorrectly used, or re-usable areas. The evaluation shows, in addition, that a major portion of the increased potential revealed by the Space+survey comes from the easily accessible public transport sites.
To generalise the results from the Canton of Basel land, the following first conclusions are presented:
1) There is much more surface area potential for re-development in Switzerland than has been assumed until now. Re-development should be focussed on the easily accessible sites made available from the public transport sector.
2) Communities need to develop re-development strategies and these must take all the potential areas for re-development and their connection to public transport into consideration.
3) Communities must work out the balance of land use as an essential foundation for a re-development strategy and the subsequent zoning plan revisions.
4) Whenever possible and meaningful, cooperative action across the community, cantonal and federal levels should be promoted.
5) A 'balance sheet' on land use (similar to that used in public financing) should be made available to the governments on the community, cantonal and federal levels on a regular basis. This should make land use easily apparent. Naturally, in cases of uncertainty, all short-, middle- and long-term offers and demands must be compared.
The experience with the survey in Baden-Württemberg

and Basel land allows the calculation of the following estimate, considering only the reserves in the area: from 10 m2 up to 20 m2 per person. This corresponds to 7.5 million residents to ca. 7.500 to 15.000 ha reserves in sites made available from the public transport sector. This makes it possible to consider the idea that the potential for re-development through social and economic change can grow even further. That alone makes the forward projection gained from this overview significant to promote and improve the (re)development of existing urban areas. Moreover, additional financial tools are necessary to improve the profitability of brownfield (re)development. With respect to the latter, both national subsidies and fiscal interventions can be considered.

Land use and consumption in England: how is land use controlled and monitored? How has land use changed?

Keiron Hart

The formalised development of the Town and Country planning system in England was driven in the late 18th and early 19th century by public health needs. This was becoming more critical following a population explosion, and the social shift to living in towns and cities. These issues were so acute that Government intervention was required. The initial planning system did not develop from a vision of land consumption control.
A variety of Planning acts created by Central government have developed to provide us with the system England has in place today. This will continue to reflect the needs and requirements of an evolving population.
England has a system of official Planning policy statements (Pps) and Planning policy guidance (Ppg), as well as best practice documents.
These provide a framework for Local planning authorities (Lpa) in determining issues of balance and priority on land use matters, all of which is delivered under the national Town and Country planning legislation. At a local level each Lpa must produce Development plans, which detail proposed land uses.

Land use today
In England there is a clear strategy to recycle previously used land wherever possible. Demand for housing and the associated infrastructure constitute the main pressure for the development of land in rural areas. Within existing urban areas it is the need for housing that also drives the recycling of land that has previously been used. Central government guidance on the recycling of land (Pps 3: Housing - Dclg, 2006) states that by 2008 60% of all housing needs should be met by using previously developed land, or the conversion of existing buildings.
In 2005 73% of new residential dwellings of all types were built on previously developed land. Only 3% of this figure was the conversion of existing buildings (Dclg). To maximise the efficiency of land use Pps3 seeks to guide the density of residential dwellings per hectare (ha): a figure of 36 per ha could be achieved. In 2006 the actual average number of dwellings per ha being developed stood at 41 (Dclg 2007).
During the period 1996-1998 approximately 8,000 ha of land changed from previously developed, to developed. Approximately 2,700 ha went from developed to undeveloped (mainly from mineral works being returned to ‘undeveloped’ land).
In 2002 an estimated 66,000 ha of previously developed land was available for re-development, 29,000 ha of which were both suitable and potentially available for housing with an estimated capacity of 880,000 new dwellings.

Housing is not the only pressure on land use in England. England has an established system for data collection which is delivered both nationally, and locally, by different organisations. The Department for Environment, Food and Rural Affairs (Defra) delivers the collation and coordination of much of this work. However, this Government agency works closely with the Department for communities and local government (Dclg) and other government agencies.
In the spring of 2006 the most recent version of the Land use and Land cover classification was published. This sought to harmonise existing classifications to facilitate. This system ensures that multiple organisations adhere to similar principles when collating data.
Accurate land use data is vital to provide the basis for sustainable development.
Central government have been sponsoring this data collection since the early 1970's. It is widely accepted that this information is incomplete.
A National land use database (Nlud) has been established. The objectives are:
– to establish a national system for naming and defining groups of land use and land cover features;
– to provide a nationally consistent basis for identifying, recording and reporting land use cover;
– to serve as a standard classification.
In summary this system splits England into 13 divisions which contain a total of 51 classes (not shown).

Conclusions
Pressures on land use within England are acute. A well developed system of delivery for guiding policies, statements and law from Central government is effectively delivered at a local level. Accurate data on land use is fundamental to the process of long term strategic planning. Standardising the data sets facilitates multiple organisations to feed information to a central data base.
Housing places one of the strongest pressures on the consumption of land. A clear strategy of recycling previously developed land has been established.
This is supported with Central government policy, which seeks to achieve prescribed minimum densities to ensure efficient land use when new dwellings are built.
The value of accurate data collection and clear enforcement and delivery of national policies delivers a regionally consistent development pattern that can be effectively monitored. This monitoring, combined with an awareness of all the other issues, facilitates the management of land consumption in England.

Assessment of sustainable land use in Germany: the project Fin.30

Sophie Schetke, Theo Kötter, Benedikt Frielinghaus, Dietmar Weigt

During the last years, urban expansion and the development of settlement areas have been the driving forces of an enormous consumption of land, the usage of natural resources and the loss of ecosystem services in Germany. In the wake of continuous land consumption the German government has elaborated a quantitative benchmark fostering reduced land consumption towards 30 ha/d in 2020 from 114ha/d today (Deutscher Nachhaltigkeitsrat 2004). To realise this enormous step politicians as well as urban planners are demanded to focus on inbounded and concentrated settlement development characterised by re-densification of built-up areas and land recycling of brownfields (Kötter and Weigt 2006).
Against this background the paper presents a multidimensional approach of the research project Fin.30 to realise reduced land consumption and to assess the manifold impacts of continuous urban sprawl on sustainable settlement development. Fin.30 is a research project of the University of Bonn (Department of urban planning and real estate management) funded by the German ministry of education (Bmbf) under the roof of its research initiative Refina (Research for reduced land consumption).

Decision making for reduced land consumption
The contribution of the research project Fin.30 to the named lack of planning-oriented tools and methods to reduced land-consumption is twofold. In addition to negative ecological and social impacts of ongoing urban sprawl increasing economical deficits in lots of German communes coping with follow-up costs such as costs of maintenance and financing of new infrastructure can be stated. Picking up the two tasks of current land use planning – sustainable and economical reasonable development - Fin.30 focuses on two major elements.
The first module of the project Fin.30 is the conception of a Mca-scheme covering the three dimensions of sustainability. It aims at analysis, decision-making and monitoring of land use in coping with sustainable spatial development (see also Kötter et al. 2008, submitted). The scheme of Fin.30 is applied at the scale of preliminary, strategic land use planning on municipal level. The assessment strictly focuses on new residential land displayed in municipal land use plans of three case study areas. Figure on this page a short insight into the hierarchical construction of the Mca beginning with categories highlighting the scientific focus of the operationalisation of the three dimensions being subdivided into criteria. The last step is formed by quantifiable indicators for the three dimensions which are explained in the following

paragraphs.
In terms of ecological impacts, such as the impact on recreational function, biotope quality, the loss of valuable farmland or the persistence of protected areas by additional housing, the centre of assessment covers aspects such as resource protection and natural risks potentials which have to be taken into account during the planning process (see German federal building code, environmental impact assessment act, Federal nature conservation act). Driving forces for planning-oriented indicators are the assessment of Ecosystem functions (see Constanza et al., 1997; Millennium ecosystem assessment 2005; Schetke et al., 2008, submitted) being affected by additional settlement areas, the use of natural resources such (e.g. valuable soil, biotope-networks) and the natural risk potentials affecting the suitability of a site for settlement purposes (e.g. groundwater, flood-risk).
The assessment in terms of social suitability of new residential land focuses on the technical and nature-oriented quality of living surroundings and human well-being. Availability and accessibility of adequate recreational facilities as well as social and technical infrastructure (Schetke and Haase 2008) are of central interest.
A second focus is put on the attractiveness of a site in terms of climatic conditions and noise exposure and the perception of an area in terms of image.
For economic purposes the main questions concerning long-term economic effects and improvement of representation of new house settlement areas are of prime importance. Beside the compilation of project-orientated development costs mainly long-term follow-up costs are calculated in respect of applying the assessment-scheme on the level of the land use plan and in times of curtly communal budgets. The aim of the economic assessment is not to calculate the absolute financial effects but a compilation of site-related and decision-relevant monetary effects.
Beside the outlined Mca, the second module of Fin.30 is the conception of an allocation fund as a tool to execute financial balance between spatial development in inner and outer urban areas. The fund should be established on the local governmental level and its deposit will be allocated by marketable and lucrative area developments, if necessary by official appropriation. Consequently the fund will be applied neutrally, which means without straining the budget of the commune. The charged financial resource of the lucrative outskirt areas may be used to improve the efficiency of the areas in deficit in the interior zone by eliminating the economic constrains, e.g. brownfields, increased planning costs or marketing problems. Currently the implementation of funds like this is aligned with many unanswered juristic issues yet.

New perspectives and task for a realisation of reduced land consumption

Current planning processes in Germany and political goals to reduce land consumption such as the 30-ha-goals of the German council for sustainability teach us that there is still a long way to go. Unilateral quantitative planning targets aiming at an arbitrarily fixed figure of 30-hectares blur the sight for protection of natural resources and qualitative on-site assessment. Until now few practical proposals have been made to put the 30-ha-goals into practical planning. But significant spatial steering effects remain doubtful.
The conceptualization of tradable certificates of land is still under political discussion and promotes increasing land consumption of large, wealthy communes which are capable to buy certificates from smaller, poorer ones. Also fiscal instruments focusing on gradual tax charge according to localization of new residential areas within a city (inner versus outer parts) are under discussion but difficult to communicate. The last amendment of the German federal building code promoting an abolishment of environmental impact assessment of construction in inner areas by reducing environmental impact assessment, land recycling can be seen as a step backward regarding ecological purposes and less effective to steer urban development significantly.
The project Fin.30 shows that a planning-oriented Mca for on-site assessment incorporating the concepts of ecosystem functions, human well-being of living surroundings and cost-oriented settlement development can be an effective tool to implement reduced land consumption within strategic spatial planning. In addition to that a great demand for political and legal steering instruments is evident.

Interpretational figures and methods for knowledge and evaluation of land consumption: the transition matrix

Paolo Pileri, Marta Maggi

This article will deal exclusively with the methodological system applied to the subject of 'land use/land cover'.
For a while we shall avoid referring to the concept of land consumption, preferring to talk about its transformation or change. Changes in land use/land cover can be shown by means of a graph (Eea 2006): the triangle of transformations (see on p. 111, above). At the top of the triangle there are the fundamental land uses/land covers (urban, agricultural, natural) while the sides represent their transformations.
On p. 111, above, makes it possible to conceptualise the various possibilities for transforming the land from one to another, identifying certain fundamental properties that can be applied for interpreting the process. These are:
1. Type of transformation
a. Equivalent: a land use/cover is changed to another within the same category of origin.
b. Non equivalent: a land use/cover is changed to another from a different category than that of its origin.
2. Duration of the transformation
a. Permanent: land cover A is transformed to land cover B and can no longer be reversed (or it is highly un-likely);
b. Transitory: land cover A is transformed to land cover B and can be returned to land cover A (or it is very possible).
3. Outcome of the change
a. Artificial: the changed cover results in a loss or a major modification of the properties and the natural and environmental relationships that existed or potentially existed before;
b. Semi-natural: the change results in a modification that renews cyclically, but not a loss, of the properties and the natural and environmental relationships that existed or potentially existed before;
c. Natural: the change results in a regaining or restoring of the properties and the natural and environmental relationships compatible and appropriate for the site and the context.
Alongside the properties of the change it is possible to also consider the role which the type of cover of the land occupied or being occupied can acquire in the process of transformation:
a. Dominant: in this case, a land cover A is frequently what replaces other types of cover, but is rarely replaced by others;
b. Recessive: a land cover A is frequently overtaken by a certain class of cover, but rarely occupies and changes covers of other classes.
An example of equivalent change is urban regeneration where a new urban coverage replaces and renews a previous urban coverage. In this case, the duration of the transformation is permanent because the new coverage is intended to last 'forever', or at least more than two or three generations.
Turning agricultural land to natural cover can, after a certain time, be reversed, and this is why such transformations are classified as transitional. Instead land consumption can mainly be considered as a non-equivalent, permanent and artificial transformation.
The schematic conceptualisation presented is linked to the methodology of the transition matrix, used in various studies in literature and also at an institutional level by subjects such as the European environmental agency (www.eea.int.eu) for identifying, monitoring and quantifying the transformations of use and coverage of land.

Transition matrix
If the data on land cover between two points in time are available, it is possible to find out the total of the surface areas transformed, the types of cover introduced to the land and the types that have been changed. The method for producing this collection of information is known as the calculation of the transitions and is based on the compiling of a matrix called the transition matrix (see fig. p 111, below).
The matrix is based on flows, in other words, on the transformation that a certain cover available at time t0 undergoes in a specific time period $\Delta t = (t1 - t0)$. The input flow, shown on the lines, is represented by the covers at time t0; the exit flow, on the colomn, is represented by the cover at the final time t1. In the matrix cells is shown the amount of the surface area (hectares or m2) transformed. In the cells of the main diagonal is shown the value of the surface area of a certain category of land use which has remained unchanged in the time period Δt.
The matrix method therefore makes it possible to immediately obtain the absolute value (in hectares or m2) of the areas transformed by a cover (a) at time t0 to a cover (b) at time t1. For example, the value which is shown in the cell formed by crossing the line 'Nature 1999' with the column 'Urban 2004' is to be interpreted as the total of the surface area which, in 1999, had a natural cover and which was transformed in 2004 into urban cover.
The transition matrix therefore makes it possible to organise the data so that they produce certain interpretations for evaluating the environmental effects as well as the planning strategies. Some transformations have a different environmental impact from others.

The initial data for input to the transition matrix
For compiling the transition matrix it is necessary to have at least two geographic databases (raster or vector), one for each time threshold established.
These data or theme sets must be superimposed by a Gis intersection operation in order to achieve a further theme set representing the areas that have remained unchanged and those, instead, which have undergone changes. If vector theme sets intersect, polygons are obtained and, in the case of raster theme sets there will

be obtained again just pixels.
Each polygon or pixel resulting from the intersection will be characterised by a pair of attributes: 'original land cover' and 'final land cover', which assign it to just one cell of the transition matrix. Each cell of the matrix will therefore contain the sum of area values of the polygons or pixels with the same pair of attributes.

The evaluation indicators
The evaluation of the transitions can be represented by many indicators. Below are shown some that are able to measure:
– the state of the cover at a certain moment;
– the rapidity of the transformation;
– the variation rates;
– the per capita size;
– the incidence of the transformations compared to the stock of original land cover. This fundamental indicator can only be calculated with the transition matrix method.
To the indicators are added the direct measurements taken from data such as the surface areas transformed between two time thresholds t0 and t1.

Composition indicators
In addition to the direct measurements (the surface areas), this category also includes the coefficients of cover i.e. the ratios of surface areas with a certain cover 'i' to the total surface area of the territorial unit taken as reference (a fictitious geometrical area or an administrative area such as a municipality). This means being able to calculate:
– urbanisation coefficient: Surb/Stot;
– rural coefficient or agricultural cover: Sagr/Stot;
– naturalness coefficient or natural cover: Snat/Stot;
– woodland coefficient or wooded cover: Sb/Stot.
The coefficients can also be obtained considering as the denominator the total surface areas net of the water areas (not modifiable) or, except for the urbanisation coefficient, also excluding the urbanised areas because no longer reversible and which can therefore no longer be turned to agricultural or natural use/cover.

Rapidity indicators
This category includes the rates of change of the cover type i.e. the ratios of the variations in the cover 'i' in the time interval (t1 – t0) to the total of the cover 'i' at the initial time t0. These indicators provide an interpretation of the rapidity with which certain types of cover increase or decrease.

Rates of variation
This group of indicators is given by the result between the changes in cover 'i' in the time interval (t1 – t0) and the time measure of the same interval (t1 – t0). In this case, the transformation values obtained are by days, per year, per two years, etc. This group of indicators provides a measure of the speed of transformation, making it possible to guess how long it might take for the transformation processes to alter the existing landscape structures.

Per capita indicators
One of the options possible for normalising the territorial magnitudes is the one that involves weighting the magnitude in relation to the number of resident inhabitants. Generally, when the value of the urbanised areas per inhabitant is high, this means that the urban spread is greater. Also the rapidity indicators can be efficiently expressed by normalising their numerical value with the number of inhabitants. In the same way, the simple figure of the surface area transformed between two time thresholds t0 and t1 can be related to the number of inhabitants.

Incidence indicators
This group of indicators is probably the most interesting and is the one that can be calculated only if the transition matrix has been completed. The percentage indicators measure the transformation of a certain cover 'i' at the expense of a starting coverage 'j', compared to the stock of cover 'j' initially existing. For instance, the urbanised cover accomplished in the time interval $\Delta t = (t1 - t0)$, only regarding the part that has occupied previous agricultural use/covers, is compared to the initial stock of agricultural cover (t0). In this way, there is directly compared the transformation with respect to the resource that it, itself, has transformed and it is made possible to 'weight' the responsibility of the 'transforming' coverage. This is a method that shows the responsibility of the driving forces as well as the effect of the transformation on the land resource. These indicators are usually measured as a percentage.
– Rate of urban transformations on agricultural land compared to the initial agricultural stock: (URBΔt)su_agr/AGR t0 [%]
– Rate of urban transformations on natural land compared to the initial natural stock: (URBΔt)su_nat/NAT t0 [%]
– Rate of agricultural transformations on natural land compared to the initial natural stock: (AGRΔt) su_nat/NAT t0 [%]
– Rate of natural transformations on agricultural land compared to the initial agricultural stock: (NATΔt)su_agr/AGR t0 [%] – […]
In theory, these indicators can also be calculated for the urban areas turned to agriculture uses for example but, in practice, will have zero or next to zero values.

Application of the method: transformations in Lombardy between 1999 and 2004
The methodology of the transition matrix has been applied to the Lombardy territory. The starting figure available consists of two land use/cover maps, in raster format, relating to the years 1999 and 2004, with a spatial resolution of 30x30m, produced on the basis of a key which includes 19 classes of land use/cover, processed

by the Arpa Lombardia Remote sensing laboratory based on Landsat-Tm (Thematic mapper) satellite images. Extrapolating data made it possible to compile the transition matrix of table 1, on p 112, which was only organised on 11 classes of land coverage (Pileri 2008).
In table 2, on p. 113, there are shown the surface areas changed and the percentage indicators calculated based on a series of transition matrices organised to reveal the transformations between 1999 and 2004 in the two areas surrounding Milan and Brescia.