

Pitou van Dijck (ed.)

C U A D E R N O S D E L C E D L A

What is the Future for Amazonia?

*Socio-Economic and Environmental
Transformation and the Role of
Road Infrastructure*

28



WHAT IS THE FUTURE FOR AMAZONIA?

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SOCIO-ECONOMIC AND ENVIRONMENTAL
TRANSFORMATION AND THE ROLE OF
ROAD INFRASTRUCTURE

PITOU VAN DIJCK (ED.)

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SOCIO-ECONOMIC AND ENVIRONMENTAL TRANSFORMATION OF AMAZONIA: INTRODUCTION

PITOU VAN DIJCK

Introduction

Amazonia has become a significant platform for the exploitation, processing and export of natural resources. Land use maps show the growing size of territories in use for mining, including small-scale gold digging, small and large-scale cattle raising and agriculture, production of hydro energy, and timber logging. These activities are supported by an inflow of foreign and domestic direct investment; flows of migrants; the construction or improvement of transport infrastructure like roads, railways, water and air transport facilities; and (hydro) energy-related infrastructure including storage lakes and high voltage transmission lines. Moreover, the spread of a network of service centres contributes to the creation of an enabling environment for human settlements and economic activities. Hence, amidst the forest a new natural resource-based economy is being developed. As a consequence of these interrelated developments, the anthropogenic pressure has been increasing significantly, be it that municipalities, provinces, regions and states in Amazonia differ widely in terms of socio-economic development, speed of change, mode and degree of connectivity, and anthropogenic pressures on the environment. Intensification of economic development and related environmental impacts are expected to increase in view of the improved

accessibility of the area and growing world demand for natural resources at relatively high prices.

Overviewing the available data sets on socio-economic developments, environmental conditions and anthropogenic pressure it follows that regions, states, provinces and municipalities in Amazonia differ widely in these respects. See Van Dijck 2013 and 2014. The areas that have traditionally been most developed and deforested in Brazilian Amazonia were located at the region's eastern, south-eastern and southern borders, where most economic activities, infrastructure and people used to be concentrated. Manaus has always been a highly peculiar economic hotspot as the largest metropolitan city in the forest. More recently new centres of gravity have emerged, changing the socio-economic landscape significantly. The study by Buitelaar in Chapter 2 of this Cuaderno shows wide diversities in levels of socio-economic development in 29 territories in five countries in Amazonia and the emergence of some of them. In general, increased intensity of economic activity in Amazonia is related with intensified infrastructure, increased anthropogenic pressure and deforestation.

The current emphasis on the exploitation of the direct use values of Amazonia may increasingly conflict with the potentials of the area to generate actual and future indirect use values like water regulation, fire prevention, carbon sequestration, and as a stock of biodiversity. These indirect use values generally become available to local or regional communities or even to the world as a whole as (quasi) public goods. Notwithstanding the significant size of areas that are protected to different degrees to serve the livelihood of their indigenous inhabitants or to safeguard biodiversity and eco-systems, the options to protect effectively these indirect use values, existence values and optional values of the territory are being reduced by the increased ease of access to the region as a whole, its growing population and encroaching economic activities.

This study focuses on the critical role of roads in the process of socio-economic and environmental transformation of Amazonia. In all countries in Amazonia road construction has become a priority at all levels of governance. Over the last two decades plans have been developed and implemented at the regional, state and provincial levels as well as the level of municipalities to expand road networks. Alternatively, private investors in mining, hydro-energy and other types of natural resource exploitation have been involved in road construction to support their private ventures. Moreover, governments and private investors have cooperated in public-private-partnerships in road construction.

With the growth of the road network, the availability of large private investment funds, and high international demand for natural resources including food and industrial inputs, roads increasingly

play a key role in supporting economic and social change and with it change in land use. Roads may have been constructed for specific objectives at a macro-economic and strategic level, as part of a development plan for sub regions and municipalities, or at the level of individual enterprises and investors. However, once constructed for whatever purpose, by far most of these roads function as public goods characterized by free access for all as exclusion of users is nearly impossible. This contributes strongly to the critical role road play as mechanisms to induce change in and beyond adjacent territories, and to steer regional development and transformation. Moreover, the areas adjacent to the roads in many cases are beyond effective control and consequently also show characteristics of quasi-public goods or localized club goods in some respects. Even so-called protected areas are impacted by roads in their vicinity as protection and control in many cases are less than optimal.

Road construction In Amazonia started in the 1960s as part of national programmes to colonize the forest and integrate Amazonia with the rest of the economies. The construction and improvement of roads has been accelerated since the 1990s and particularly since the beginning of the new millennium. The currently introduced programmes aim at improving the connections between extraction areas with ports and at connecting efficiently producers like mining corporations and food producing enterprises with forward and backward linked suppliers of goods and services, such as suppliers of local facilitary services and of energy. Large-scale infrastructure programmes have become a priority in government policy, planning and budgeting in Latin America and the world all over International market penetration are in-time delivery are key ingredients of successful open macro-economic growth models, particularly in small countries. Internationalization may imply that countries have an economic interest in the quality and lay-out of infrastructure of their economic partners and neighbours which in some cases may be a rationale for strategic cooperation and investment in infrastructure abroad.

Not only globalization but regionalization as well impact on the priority for specific trajectories and on the lay-out of the infrastructure and related economic developments. In the context of relatively open economic development models pursued in many countries in South America, the spread of intra-regional preferential trade agreements and bilateral investment treaties, construction of a supporting regional road infrastructure has become a priority as reflected by the programming of IIRSA and COSIPLAN/UNASUR. Interestingly, some border areas adjacent to these newly constructed or reconstructed international roads have experienced a new type of development. Special development programmes have been designed to support and order the development of such border regions as is the case with Zicosur connected with the IIRSA Capricorn hub; the MAP

initiative integrating Peru's Madre de Dios, Brazil's Acre and Bolivia's Pando regions; and PADIF, dealing with developments in the Andean region.

The next section of this chapter presents briefly some significant road programmes in South America which play a key role in the reshaping of Amazonia. The third section focuses more specifically on the local impact of roads on land use and deforestation. The fourth section clarifies the potential contribution of strategic environmental assessments (SEAs) and related plans of action to reduce negative environmental impacts of roads – like deforestation, disruption and destruction of eco-systems and loss of biodiversity – and to support potential contributions to socio-economic development. The final section presents briefly the main topics dealt with in this Cuaderno del CEDLA.

Mega-road programmes

Infrastructure investment throughout South America has been supported by initiatives at the local, regional and national levels and by a continental-wide programme. The Brazilian Programa de Aceleração do Crescimento (PAC) is a significant example of a nation-wide approach in which infrastructure as such is considered a major driver of renewed economic growth. The Mato Grosso State Programa Estradeiro is a major case of an infrastructure development programme designed and developed at the state level with emphasis on public-private partnerships. See Van Dijck and Den Haak 2006. The Integration of Regional Infrastructure in South America (IIRSA) is a rather unique effort to support integration among countries in the region and to support the region's insertion in global markets and particularly markets in Asia. See Van Dijck 2013. Hence, these programmes aim at supporting a major spatial and functional reorientation of the economies. Moreover, in the course of time these mega roads will develop into the backbone of a newly induced pattern of side roads linking new production sites with markets and related processing facilities. The so-called fishbone pattern of roads is the physical and spatial reflection of the aim of the road programme: the creation of axes of development and integration. The IIRSA and PAC programmes of mega- roads speed up land use conversion, deforestation and the construction of linked road networks in adjacent territories. Ahmed et al (2013) found that during the period 2004-2007 the road network in Amazonia increased by almost 17,000 km on an annual basis. See Maps 1.1, 1.2 and 1.3.

Although some public-private partnerships have emerged, most of the road construction has been initiated and financed by national, state or local governments, in cooperation with national or interna-

tional development banks like the IDB, CAF, BNDES and others. Chile has introduced some interesting and renovating partnerships in road building. The Mato Grosso State Programa Estradeiro, initiated in early 2003, is another case in point.

Concerning the priority for new lay-outs of multi-modal transport systems and networks, we note that in general terms the lay-out needs to match the direction of trade flows. The existing infrastructure network is largely determined by historical trade and transport patterns. Rapid changes in the location of centres of economic gravity related to the emergence of national economies or regions, or to the liberalization of national or regional trade and investment regimes, have strongly stimulated the priority to redesign and to supplement the existing infrastructure lay-out. New roads connect the south with the Amazon River and the centre with the Caribbean Sea. Port improvement in the Guyanas and along the Caribbean Sea coast improve connectivity with the Panama canal and in the future maybe with the Nicaragua canal. Moreover, the connections between the east and west side of the Amazon territory is being improved to facilitate transport of (bulk) goods between Asia and South America.

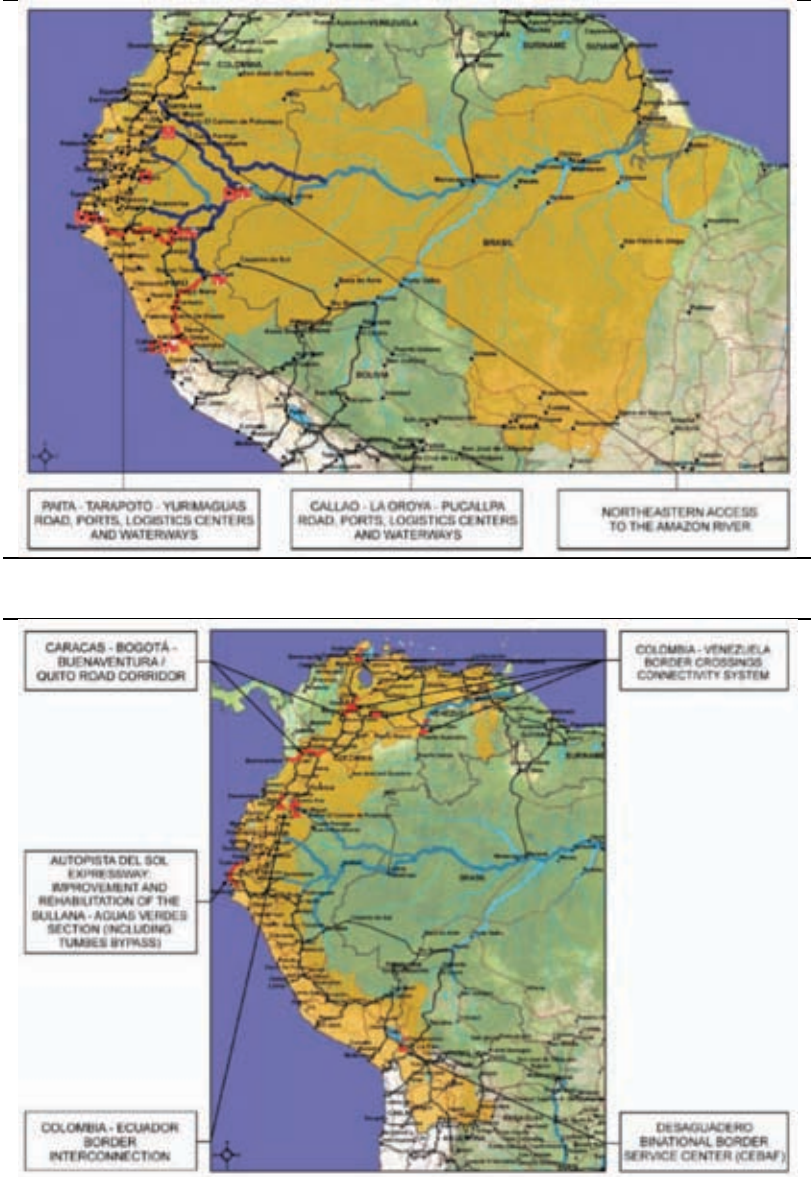
IIRSA

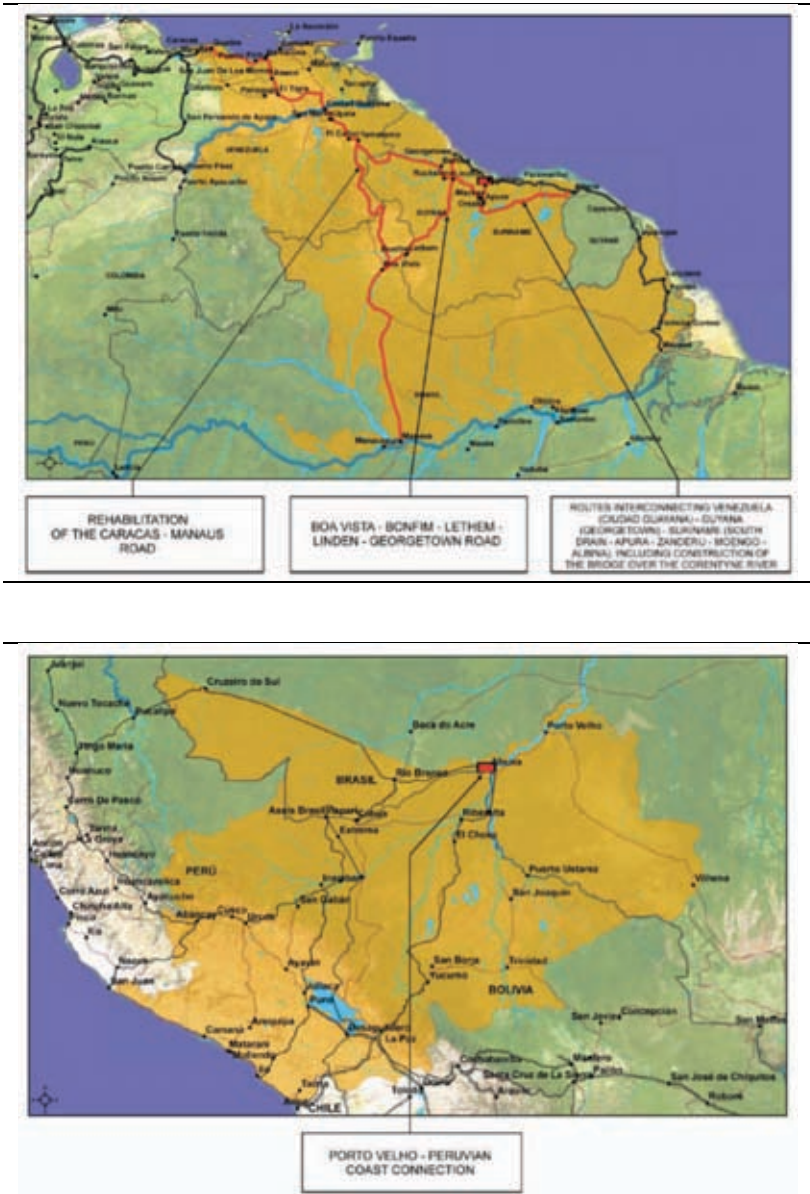
The creation of IIRSA in 2000 initiated an ambitious, region-wide effort to bolster economic development by deepening integration and strengthening the region's position in the globalization process. All countries in South America participated in the programme for an initial period of ten years (2000-2010). Subsequently, UNASUR has embedded the IIRSA initiative as part of its COSIPLAN, which was established in August 2009. IIRSA is organized in a series of so-called development hubs, *ejes de integración y desarrollo* or *eixos de desenvolvimento*. This concept had also been applied in the context of the Brazilian infrastructure programme PAC.

The concept of development hubs is critical to the understanding of both the objective and the potential impact of IIRSA road infrastructure. As put by the Inter-American Development Bank (IDB):

[t]he concept of the hub is novel in that it attempts to fully address the economic, social and environmental dimensions of physical integration and their interplay in the project development process.... IIRSA's comprehensive approach to projects sets a priority on environmental protection and is responsive to a growing awareness of its importance by the people of the region. Organized society and elected governments are increasingly attuned to this reality. The IIRSA approach of applying the concept of hubs helps address environmental issues in a structured way and offers planners and other stakeholders a vision for development opportunities, alternatives and needs to ensure effective and balanced regional integration (IDB, October 2006, p. 17).

Map 1.1 IIRSA plans for infrastructure in Amazonia





Source: UNASUR COSIPLAN Integration Priority Project Agenda, November 2011, Map 5, p. 43.

Map 1.2 PAC plans for infrastructure development in Brazilian Amazonia

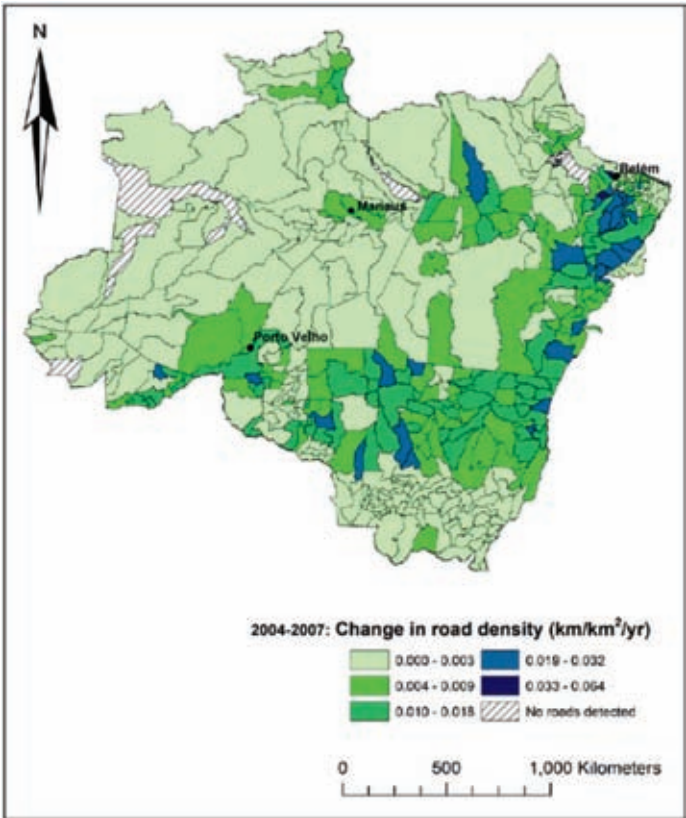


Source: PAC 2 | 9º Balanço 2011 > 2014.

The Initiative focuses particularly on improving the interconnections among the national road networks, improvement of strategic waterways and railways, border-crossing facilities, ports and airports, telecommunications and energy facilities. In some respects IIRSA objectives, agenda and approach is comparable with the infrastructure programmes of the EU. As multi-purpose, multimodal and regional infrastructure programmes, both IIRSA and the EU programmes aim at deepening integration with neighbouring countries, at strengthening the position in the globalization process, and at developing backward or lagging areas in national economies, as reflected by the concept of development hub in the IIRSA agenda. In both regions, transport, energy and telecommunications networks have been developed by national programmes, and both regions aim at connecting, integrating and harmonizing the national networks into the wider regional context.

Note however that at least so far IIRSA has made only limited progress to realize its ambitions and plans (IDB 2008). Specifically, by far most of IIRSA related investments are concentrated in only two of the nine IIRSA development hubs: the Mercosur-Chile hub and the Peru-Brazil-Bolivia hub. Moreover, the ambition to stimulate

Map 1.3 Road construction in Brazilian Amazonia, 2004-2007



Source: S. Ahmed, C. M. Souza Jr., J. Riberio and R. M. Ewers, 'Temporal Patterns of Road Network Development in the Brazilian Amazon', *Regional Environmental Change*, Volume13, 2013, pp. 927-937.

sustainable development by linking finance for infrastructure with thorough environmental assessments has been put under pressure by governments as well as financial institutions in the region requiring such assessments to be made in a relatively short period of time and with a limited budget.

PAC

Brazil started a new model of economic and social development during the first term of President Lula da Silva in which the development of infrastructure was considered one of the pillars for growth, development and poverty alleviation. PAC aims at building up the conditions to assure sustainable growth for the medium and long term, in cooperation with the federal government, states and the private sector. The main part of the budget for infrastructure is allocated for the construction of roads and waterways, and only a small

part for railroad construction and improvements of ports. Many of these projects are complementary to the IIRSA plans.

The basic approach underlying IIRSA and PAC is similar: stimulating integration along corridors such as roads, railways and waterways. Hence, transport infrastructure stimulates regional development in adjacent territories by crowding in private investment. This new approach towards regional planning and development was introduced in a study by Consórcio Brasileira 2000, commissioned by the national development bank of Brazil, BNDES, and the Brazilian Ministry of Planning (Gartenkraut 2002; see also Fearnside 2002).

Roads and land use conversion

The impact of roads on the use of natural resources and their use values, and more broadly on the environment, may be measured, assessed and modelled in the so-called impact area of economic activity or infrastructure. These territories may be sizeable in view of the measured impacts of roads in the past. Moreover, impacts may extend beyond the borders of the impact area in terms of their effect on precipitation and fire risks, and global warming. Fragmentation may reduce the size of territories available to species to a level below the minimal size required for survival and reproduction. The opening of the forest may contribute to local drought and a higher susceptibility to forest flammability. Finally, improved access of the forest facilitates legal and illegal timber logging, hunting, trading in endangered species, and consequently reduces biodiversity. The tensions between the potential beneficiaries of different use values of specific territories is studied in more detail in the case of Ecuador's Oriente in Chapter 3 of this Cuaderno.

It needs to be observed, however, that impacts of roads on land use in adjacent and more distant territories depend on a number of variables that are frequently included in land use modelling: distance to types of transport infrastructure and to population centres; quality of the soils and climatological conditions; and distance to protected areas. Generally speaking the closer an area is located to infrastructure the more deforested it will be in the course of time; the more suitable land quality and the environmental conditions for production are, the more probable deforestation. Alternatively, protected areas are an effective instrument to reduce deforestation and land use change. See Kaimowitz et al 2002 and also Chapter 4 of this Cuaderno. Market related variables like volumes and types of demand and prices are not used in most land use models although these variables impact indirectly on demand for specific types of land and hence on land use change. From the above it follows as well that

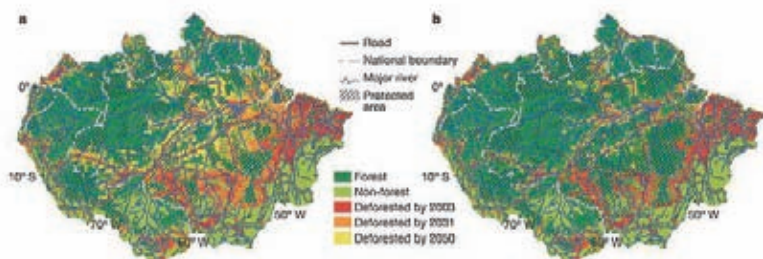
land use conversion is not a once-and-for-all process but may continue in the course of time with changing circumstances.

Planning at the national, regional and local level can support an orderly transition in land use as induced by the construction or pavement of a road. From the perspective of policy three stages may be distinguished: corridor routing and design; ex ante assessment of potential impacts; design and implementation of policies to support potential positive impacts and reduce negative impacts.

Optimal corridor routing may contribute to the design of a road trajectory that reflects the interests of the different stakeholders in the construction of the road. Not unlikely, routing is designed from the perspective of a small number of interest groups, including the national regional and/or local governments that are involved, the financing institutions that are involved and a limited number of large and probably well-organized stakeholders and interest groups that are involved from the start. Alternatively, by applying a multi-dimensional approach that includes several perspectives and interests such as economic, transport, social, and environmental perspectives, and by weighing these interests, a routing of the corridor may be designed that reflects more accurately the general interest in the corridor.

Modelling exercises by Soares-Filho et al. (2006) show that impact areas of roads, with a high concentration of economic activities, play a key role in the transformation of Amazonia. Based on scenario studies with 31 major road projects throughout (Brazilian) Amazonia, the studies show that such impacts may be reduced significantly in case of good governance and effective use of protected areas as compared to outcomes in a business as usual scenario. Nevertheless the environmental restructuring of Amazonia as a consequence of its socio-economic restructuring may be spatially significant as illustrated in Map 1.4.

Map 1.4 The future of Amazonia?



Source: B. Soares-Filho et al. 2006, according to the Business as Usual Scenario (a) and Governance scenario (b), 2050.

Strategic environmental assessment

A SEA may further contribute to the enhancement of potential welfare effects of road construction by creating the foundations of policies in support of potential positive welfare effects and reduction of negative welfare effects. SEAs are not a new tool and are part of the decision-making process on construction of infrastructure in many countries the world all over, particularly in countries at high income per capita such as the EU, USA, Canada, Australia and New Zealand. Experience with application in Latin America and more specifically in Amazonia is limited and shows much room for improvement as follows from the chapters by Van Dijck, Wallis and Van Barneveld in this Cuaderno. Moreover, the legal status of SEAs differ among countries: in some countries such as Brazil SEAs are required in the context of the decision-making process concerning road construction but that is not the case in several other countries in Amazonia and the Guyanas. Also, SEAs are required in case of co-financing by multilateral financial institutions in the context of IIRSA, but institutions like IDB and PAC differ in their SEA requirements.

Modelling of the impact area can support the understanding of the probable geographical spread of impacts in the course of time as well as of the types of impacts. See Chapter 4 of this Cuaderno. This type of assessment may generate insights in the types of territory, landscapes and eco-systems likely to be affected by road construction. However, to generate knowledge on the economic consequences of land use change, that is: on the economic consequences of deforestation, and related loss in direct and indirect use values as well as other types of values of the forest and eco-systems, a much more comprehensive set of data will be required. The latter type of insight is hampered in particular by the lack of market signals and the inadequacy of alternative methods to assess indirect use values of (potentially impacted) territories (Van Dijck 2013, pp. 60-77).

Insight into the potential environmental and socio-economic impacts for the local populations can be enlarged by following a participatory approach in the assessment process. This involves the exchange of information with the population in the impact area – that is: dissemination among the population of information on the infrastructure, and the collection of information obtained from the local population concerning potential impacts as perceived by them. Such an approach is required by some multilateral institutions and governments involved in (co)financing of infrastructure and is specifically required in case ‘free prior and informed consent’ is a precondition for the construction of infrastructure, which usually is the case when indigenous lands are traversed. Although such information may be helpful in understanding the potential impacts as perceived by local populations, and in formulating proposals and initiatives in

support of welfare maximization among these populations, it needs also be realized that such perceptions may be based on incomplete and partly false information, biased by traditions, assumptions and short-term interests. If these conditions apply, the approach may be of limited use for planning purposes concerning the lay-out of a specific trajectory, the selection of appropriate means of transportation – road, railway or waterway – and the preference for specific policy instruments and objectives. Hence, the participatory approach may be helpful, is not a panacea, and may also be misleading.

Final challenge is to design ways in order to integrate in an effective and efficient manner the outcomes of the SEA, as formulated in the strategic plan of action, into policies at the national, regional or local level. In that context two challenges need to be met. First, in many instances the outcomes of SEAs are only available at a moment in time that does not allow their adequate implementation. This holds particular for outcomes that pertain to the selection of the trajectory and mode of transportation. Appropriate timing is the required solution. A survey of SEAs in South America has shown that timing is among the major inadequacies of the SEA procedures in the region (Kis Madrid 2006). The second challenge is more complicated to meet: integration of elements of the plan of action at the appropriate moment in the more distant future. The construction of infrastructure may require a long time period that may exceed the duration of one or several political cycles. This calls into question the political commitment of future governments to implement elements of action plans that may fit only in part with the political priorities of the future. More in general, a long-term vision and agenda is missing in many countries, and governance institutions capable of dealing with long-term planning are lacking.

The second challenge is finding the optimal level of governance to implement the elements of the strategic plan of action. This holds particularly for socio-economic and environmental issues to be addressed in a spatially widely dispersed impact area. In the context of planning and impact management, the subsidiarity principle may be a fundamental and practical guideline for the selection of the optimal level of governance to deal with the issue: the principle indicates that the optimal level of intervention is the lowest possible level of governance at which effects can be internalized. In the case of locally concentrated impacts of infrastructure the optimal level of government intervention may be the level of the municipality, but in case of widely dispersed effects, like pollution and land use change, the provincial or regional level may be more appropriate from the perspective of management and governance. Chapters 6 to 7 deal in different ways with these policy-related issues.

Organization of the Cuaderno

The chapters of this Cuaderno focus on several often interrelated dimensions of the transformation process in Amazonia, and policy requirements for embedding these changes. Chapter 2 by Ruud Buitelaar presents a broad framework for analysing and describing these changes Amazonia wide, at the levels of states, provinces, departments and municipalities. The study distinguishes 29 territories in five countries in Amazonia and shows the wide diversity in socio-economic levels of development as well as speed of transformation. The chapter presents summarily an overview of regional development policies and focuses in particular on the new role of local governments. Chapter 3 by Rob Vos deals briefly with recent changes in Ecuadorian Amazonia, the Oriente, induced by oil discovery and exploitation and by the agricultural reform programme that has promoted agricultural colonization of the forest. The study focuses on the variables having an impact on poverty alleviation and the conversion of forested land into agricultural lands. The study concludes that an alternative type of development may be more conducive from the perspective of sustainable socio-economic and environmental development. Chapters 4 to 7 deal in different ways with analyses and assessments of impacts of roads in Amazonia and with policies and programmes to optimize these impacts from a socio-economic and environmental perspective. Chapter 4 presents results of a study in land use modelling of road impacts. The chapter explains briefly the functioning of the Land Use Scanner as a model to analyse probable future land use. Specifically, the chapter investigates the location and spatial development of the impact area that may result from the realisations of the government proposal to construct a road through the yet unopened forest in the interior of Suriname. Chapter 5 by Marinella Wallis focuses on the policies related to the decision-making process regarding the construction of the Manaus-Porto Velho hub in Brazil and the related impact assessment of that very road. The study deals with a rather extreme case in which a comprehensive and sophisticated SEA has played a significant role. Chapter 6 by Bert van Barneveld draws lessons from the impact assessment of the Corredor Norte, linking La Paz with Bolivia's borders with Brazil and Peru, and from some other experiences with SEAs in Amazonia. The chapter deals particularly with the role of stakeholders' participation in the impact assessment and in the formulation of a strategic plan of action. Moreover, the chapter deals with questions pertaining to the relationship between such a SEA-related plan of action and the broader local, regional or national policy context. Chapter 7 brings together conclusions from these studies and from studies recently undertaken in the context of two CEDLA research projects on the impact of extractive economic activities in Amazonia and on the im-

pact of mega-road programmes in Amazonia. In addition, the chapter focuses on several options to establish linkages between SEAs and regional and multilateral treaties.

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SUSTAINABLE DEVELOPMENT IN THE AMAZON: TERRITORIAL DISPARITIES AND INTEGRATION STRATEGIES

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The Amazon region presents major sustainable development challenges. In general, productivity levels and social indicators are low and nature is under strain. These are concerns at the levels of global, national and local governments and communities. Planning for sustainable development of the Amazon has come a long way since the 1970s when development programmes encouraged migration to colonize the area. At the time, government programmes in Ecuador, Peru and Brazil in particular encouraged deforestation as a requirement to obtain property rights, forever changing patterns of territorial occupation of the Amazon.

Global environmental concerns started to permeate national development plans in the late 1970s, shortly before the international crisis of the early 1980s imposed a shift in development paradigm away from top-down state planning. The crisis of the 1980s and the market-orientated development strategy did little to redress the negative environmental consequences of development in the Amazon. It was not until the 1990s that environmental sustainability became a prominent concern at all levels. At about the same time, development planning was reinvented and the process of decentralization of competencies to local governments advanced. A new actor came on the planning scene: the subnational government, often with direct partic-

ipation of civil society. Most if not all first and second-tier subnational governments in the Amazon and elsewhere now have formulated sophisticated long-term development strategies.

Simultaneously, countries started to strengthen their legal framework and technical capability to promote development and manage environmental issues from a national perspective. The increasing role of local governments in development planning raised concerns at the national level about the possibility of increasing territorial disparities. In recent years, most if not all governments in Amazon countries have pursued strategies to foster a geographically more balanced development trajectory, aiming especially at promoting growth in remote and lagging regions by improving their integration in the national market economy through transport and communication infrastructure projects. These strategies also promote the strengthening and transfer of competencies to local governments.

In all countries, the Amazon rainforest remains a remote and usually backward area in terms of economic and social development levels. How is the interplay between local and national planning for sustainable development working? Have governments been able to integrate their Amazon regions in the national economy? What types of approaches have been designed? These are the questions that have inspired the present chapter.

This chapter sets out to describe the territorial entities in the Amazon poised to play a prominent role in sustainable development planning: the first-tier subnational governments. Based on information about value added per capita and socio-economic development indicators at the level of major political-administrative units in each country, the chapter illustrates the diversity of Amazon territories in Brazil, Bolivia, Colombia, Ecuador and Peru. Subsequently, the regional development strategies of the five countries are reviewed to see how they relate to this diversity. The chapter finalizes with an assessment of the policy challenges regarding the strategy to integrate Amazon regions in the economic and social development paths of the countries and the scope for supra-national policy coordination especially in the light of the pressure on natural capital conservation.

Socio-economic disparities in Amazon territories

The Amazon spreads across nine countries. Map 2.1 shows the Amazon region and the political-administrative divisions referred to in this chapter as well as the network of major connecting roads. Five of the nine Amazon countries publish data on productivity at the subnational level: Brazil, Bolivia, Colombia, Ecuador and Peru. In these five countries, 29 first-level political-administrative units, henceforth

Map 2.1¹ First-tier subnational entities and the road network in the Amazon



Note: The depiction and use of boundaries, geographic names and related data shown are not warranted to be error free nor do they necessarily imply endorsement or acceptance.

called territories, are in the Amazon: nine states in Brazil, three departments in Bolivia, six regions in Colombia, six provinces in Ecuador and five regions in Peru. Table 2.1 shows that these 29 territories come in different sizes and shapes. The data for the basic economic and social indicators used in this study are presented in Annex Table 2.1 and 2.2 at the end of the chapter.

Zamora Chinchipe in Ecuador covers 10,000 square km, Amazonas in Brazil more than 1.5 million. Guainía in Colombia has less than 40,000 inhabitants, Pará in Brazil more than seven million. On both counts, the smallest and the largest territory differ roughly 150 times. Population density is low, ranging from 0.5 inhabitants per square km in Guainía to over 15 in Maranhão. Evidently, these territories are a heterogeneous group. They are an important category as they have increasingly acquired public governance roles.

Map 2.1 clearly shows the low density of the road network and the lack of road connections between the few urban agglomerations in the Amazon. Isolation especially characterizes the state of Amazonas

1. The authors would like to thank David Candia for his support and skill in preparing the map.

Table 2.1 Typology of territories in the Amazon based on productivity and growth performance

Lower than national average productivity and above-average growth ('Crescent')					
Territory	2010 GDP (US\$)	2010 GDP per capita (US\$)	Density (GDP/km ²)	GDP per capita growth rate (%)	Poverty (%)
Acre (BR)	5 142	7 421	33 699	4.00	40.3
Amazonas (BR)	33 193	9 486	21 132	3.35	43.1
Maranhão (BR)	26 864	4 231	80 918	4.53	44.6
Tocantins (BR)	10 479	7 556	46 038	5.34	35.2
Putumayo (CO)	1 413	4 332	56 767	3.94	NA
Morona Santiago (EC)	280	2 043	10 917	3.05	59.9
Amazonas (PE)	891	2 156	22 706	5.17	44.4
Lower than national average productivity and below-average growth ('New')					
Territory	2010 GDP (US\$)	2010 GDP per capita (US\$)	Density (GDP/km ²)	GDP per capita growth rate (%)	Poverty (%)
Beni (BO)	570	1 281	2 671	2.10	47.4
Amapá (BR)	5 098	7 740	35 698	2.81	41.1
Pará (BR)	47 177	6 380	37 811	2.79	43.8
Rondônia (BR)	13 823	8 538	58 185	1.75	27.4
Roraima (BR)	3 864	9 031	17 226	2.76	31.8
Amazonas (CO)	201	2 794	1 835	2.04	NA
Caquetá (CO)	1 201	2 683	13 505	2.40	41.7
Guanía (CO)	96	2 515	1 281	0.78	NA
Guaviare (CO)	255	2 473	4 778	-0.93	NA
Vaupés (CO)	75	1 801	1 382	0.87	NA
Napo (EC)	453	4 411	34 159	1.47	37.4
Zamora Chinchipe (EC)	199	2 240	18 837	1.65	38.9
Loreto (PE)	3 072	3 124	8 329	3.25	47.6
San Martín (PE)	1 865	2 382	36 382	4.90	30.6
Ucayali (PE)	1 528	3 288	15 009	3.24	13.5

Table 2.1 continued

Higher than national average productivity and growth ('Full')					
Territory	2010 GDP (US\$)	2010 GDP per capita (US\$)	Density (GDP/km ²)	GDP per capita growth rate (%)	Poverty (%)
Mato Grosso (BR)	35 212	11 871	38 979	4.00	8.9
Higher than national average productivity and lower than average growth ('Waning')					
Territory	2010 GDP (US\$)	2010 GDP per capita (US\$)	Density (GDP/km ²)	GDP per capita growth rate (%)	Poverty (%)
Santa Cruz (BO)	5 360	1 924	14 464	1.39	45.7
Pando (BO)	184	2 270	2 887	0.78	35.3
Orellana (EC)	5 704	47 224	274 573	2.26	50.5
Pastaza (EC)	737	9 046	24 950	0.54	53.7
Sucumbíos (EC)	4 607	25 944	247 506	-2.07	42.7
Madre de Dios (PE)	881	7 272	10 331	4.13	4.2

Source: Own elaboration of official data recorded in CEPALSTAT.

in Brazil, Colombian departments of Guainía, Guaviare, Caquetá, Vaupes, Amazonas and departments of Loreto y Ucayali in Peru. The South American Council of Infrastructure and Planning (COSIPLAN), a forum of UNASUR member states, has among its objectives to 'promote regional connectivity by building infrastructure networks for physical integration purposes, considering sustainable social and economic development criteria, and preserving the environment and the balance of ecosystems' (IIRSA 2014). The pattern of the development of transport and logistics infrastructure in the Amazon is particularly worrisome, since the generally preferred mode of transportation, roads, is a major driver of deforestation. The first 50 km from the main highways of the Amazon concentrate 80 per cent of deforestation in the region (Alencar et al. 2004). Both the expectation and the actual paving of roads have been contributing to high deforestation rates as it induces land speculation. Nevertheless, investment plans such as Brazil's Growth Acceleration Programmes (PAC) to enhance transport infrastructure in the Amazon show that roads remain the priority. Bara Neto et al.(2006) make the following

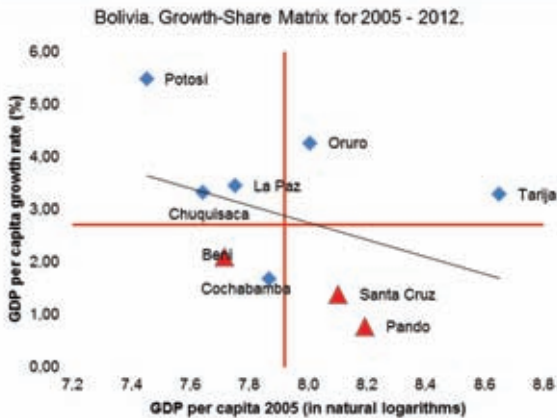
observation about modes of transport in the Amazon: ‘river navigation is essential; it is the only form of communication for most of its inhabitants and a central component of Amazon identity that is shared by all Amazon people and the mode of transport most convenient for the environmental conservation of the Amazon.’ Hence, a key question is: What type of connectivity and infrastructure is being promoted and what are the consequences for sustainable development in the Amazon?

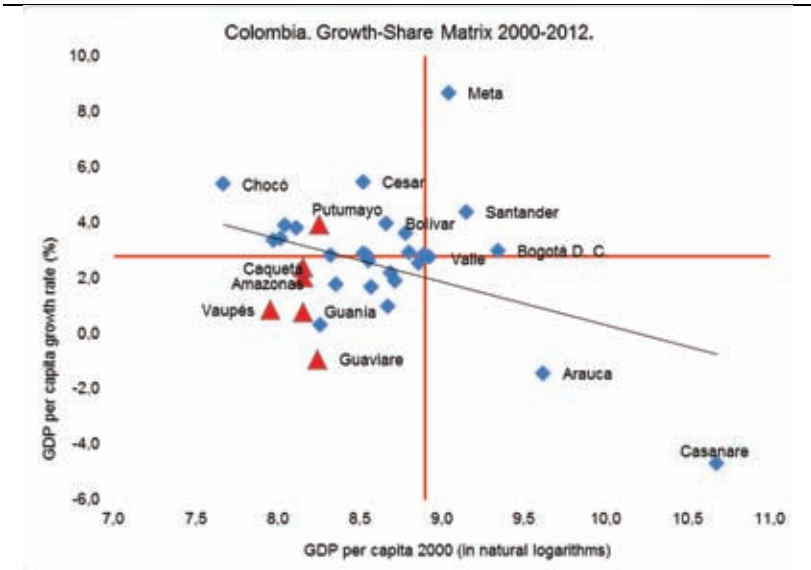
Graphs 1 to 5 depict growth-share matrixes for the territories per country, plotting initial GDP per capita on the horizontal axis and GDP growth rate on the vertical, on the basis of the most recent available time interval for each country covering the 21st century. This creates four typical situations, labelled here according to the phases of the moon.

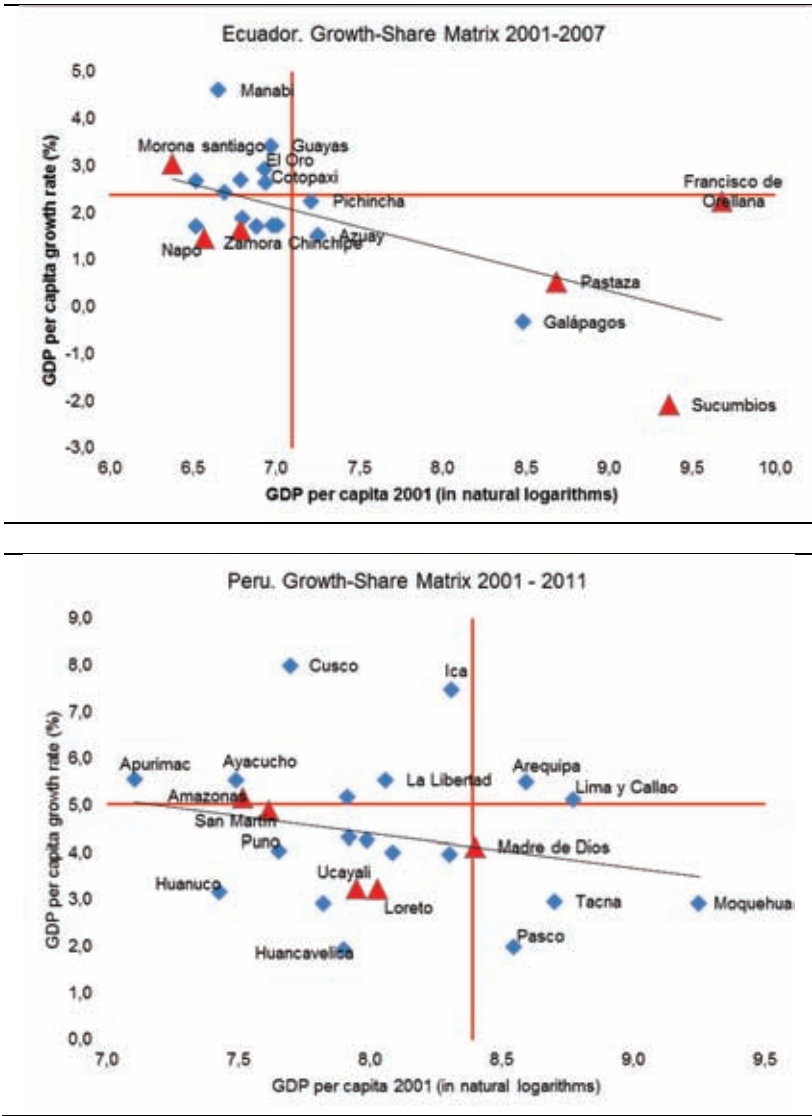
Full Moon

Only one case meets the criteria of above-average productivity and above-average growth: the state of Mato Grosso in Brazil. The level of poverty is low relative to other Amazon entities. The rainforest covers roughly half of the territory. Substantial public investment in road infrastructure and promotion of export agriculture, especially soya, resulted in record high levels of deforestation in 2003-2004. The implementation of the action plan to prevent and control deforestation in the legal Amazon was a direct reaction, as well as the ‘Operação Arco Verde’, a major public-private initiative to promote sustainable development in Mato Grosso. As a consequence, the speed of deforestation has been reduced significantly. Nevertheless, the ambitious economic development strategy continues to challenge environmental management and planning capabilities.

Graphs 2.1-5 Growth share matrix, five countries







Waning Moons

Six territories fall in the category marked by relatively high productivity and below-average growth. A closer look reveals some similarities and issues in common at least in five cases. Madre de Dios in Peru, bordering both Bolivia and Brazil, scores relatively high on the GDP per capita indicator by Peruvian standards due to gold mining activities and wood production as well as its small population size. The informal nature of mining activities hampers its growth and causes major social problems and environmental damage. The regional

government has developed a long-term vision and plan, but finds itself in open conflict with the national government. Neighbouring Pando province in Bolivia also has a higher than national average GDP per capita mainly because of booming small- and medium-scale alluvial gold mining along the Madre de Dios river. See Cremers, Kolen and de Theije (eds.) 2013.

Three Ecuadorian provinces in the Amazon, Sucumbios in the north at the border with Colombia and Orellana and Pastaza further south, bordering Peru, have relatively high levels of productivity per capita by national standards due to the exploitation of oil deposits. For a more detailed analysis of the development pattern of the Oriente in Ecuador see Chapter 3 of this Cuaderno. The Yasuni National Park is situated in the latter two provinces. Growth has been at a level below average as investment to expand production capacity was limited in the period under investigation and other economic activities such as wood production, tourism and agriculture do not have sufficient weight to affect significantly the overall growth rate in the provinces.

Santa Cruz in Bolivia is different from the previous five cases. It is similar to neighbouring Mato Grosso in Brazil to the extent that its economy is rather diversified and its population size is significant by national standards. It is Bolivia's economic powerhouse and when its per capita growth is below the national average the explanation probably is that population has increased significantly due to domestic migration from the highlands.

Keeping in mind differences and specific situations, the Waning Moon territories can be characterized by the dominant presence of a single type of economic activity such as gold mining and oil exploitation, that determines the value of production in a sparsely populated area. This economic activity tends to have limited growth potential and creates significant environmental and social conflicts that exceed local governance capabilities.

Crescent Moons

Relatively poor territories with above-average growth are mainly situated in Brazil (Acre, Amazonas, Maranhão and Tocantín). Putumayo in Colombia, Amazonas in Peru, Morona Santiago in Ecuador are also cases in point.

Acre neighbours Madre de Dios and Pando territories in Peru and Bolivia. By Brazilian standards it is poor but its economic growth has been well above national average spurred by a booming services sector. Government and public services account for one-third of GDP. Private sector production is dominated by wood and forestry products. According to the Environmental Defence Fund, stable leadership, good governance and innovative policies have enabled the state

to grow and improve social indicators while laying the groundwork for a sustainable forest-based economy.

The economy of Amazonas, the largest state in Brazil, is characterized by the special regime for federal investment and tax incentives governing the Manaus area, which has fostered the manufacturing sector, the driver of economic growth. Sustainable development in the rainforest in Amazonas state is promoted by the public-private Fundação Amazônia Sustentável with its motto ‘making trees more worth standing than cut’. For a more detailed analysis of the importance of transport infrastructure for the development of Manaus see Chapter 5 of this Cuaderno.

Maranhão state became connected with the national economy by major road infrastructure works in the 1970s. The harbour complex is the main port for commodity exports by Brazil’s northern and north-eastern regions, particularly iron ore, aluminium and soya. Close to the harbour, the Brazilian oil company Petrobras is building one of the world’s largest refineries; managing its environmental impact will be a major challenge.

Tocantins, the youngest of Brazilian states and inland from Maranhão, owes its recent economic growth to the installation of river dams for the production of electricity and investment in related industrial capacity.

The territory of Putumayo in Colombia borders Ecuador has oil production as the major driver of economic growth. Civil war and general insecurity related to illegal activities subsided in the first years of the 21st century with the increase in military presence through Plan Colombia and growing oil production. Amazonas in Peru has a rather diversified agriculture as mainstay of its economy, including coffee production and cattle herding. Morona Santiago in Ecuador also has livestock farming, together with a variety of agricultural products, as the base of its economy.

Crescent moon cases are characterized by a relatively diversified economy as compared to the overall national economy, and may include important manufacturing industry and services sectors. They still record high levels of poverty but external impulses, be it public investment or strong demand and high prices for exportable products, have contributed to their economic dynamism.

New Moon cases

Most of the territories in the Amazon record below-average productivity and growth levels.

Amapá state, north of the Amazon River and unconnected by roads with the rest of Brazil, has an economy based on services in the main city of Macapá. Forestry, agriculture and fisheries are the main industries. The state has a track record regarding sustainable devel-

opment strategies. Recently, important investments in mining, energy production and distribution, and connection of the state with the national electricity grid in 2013 have boosted production and generated novel challenges.

Neighbouring Pará state, with the capital city of Belem south of the Amazon river, is the most populous and the second largest territory in the Amazon region. The state contributes over 20 per cent to total GDP of the entire Amazon region considered in this chapter. It is a diversified economy based on large mining operations like the largest iron ore mine in the world (Carajas) and on service sectors concentrated in the port and city. Sustainable development and the governance of natural resources are the first guideline in the pluri-annual development plan of the state.

Northwest of Pará, bordering Guyana and Venezuela, is the state of Roraima, the least populous among Brazilian states in the Amazon. Its economy is based on services. The state of Rondônia, bordering Bolivia, has an economy based on agriculture and forestry products.

Cattle raising is the economic driver of development in the Beni department of Bolivia and in the Caquetá territory in Colombia. The mainly American Indian population of Vaupés and Guainía territories in Colombia, bordering Brazil, is involved in subsistence agriculture with yucca as staple crop.

The main source of income in Guaviare territory in Colombia is probably coca production. A variety of tropical agricultural and forestry products is produced. The construction of a bridge over the Guaviare river enhances connectivity with the rest of the country significantly. The Amazon department in Colombia, bordering Brazil and Peru, has an economy based on forestry products and rainforest tourism. It depends on air transport for connection with the rest of Colombia and on rivers for internal transport.

Zamora Chinchipe in Ecuador has small-scale gold production and forestry as mainstay of the economy. Ucayali territory in Peru, north of Madre de Dios bordering Brazil, has an economy based on agriculture, fisheries and forestry products. Government services and public investment provide major impulses to economic growth. San Martin is home of palm oil production.

The common characteristic of New Moon cases, with the exception of Pará, seems to be the weakness of external drivers of growth due to remoteness or isolation.

Regional development strategies

Against the backdrop of the challenge of sustainable development in the context of the significant territorial diversity in the Amazon, we now review recent national strategies to promote a geographically

more balanced development pattern. To put this in perspective, it should be noted that Amazon countries have a history of territorial development policies, which has gone through distinct stages according to scale or spatial extents, the roles assigned to the state and the market, and the specific modalities of intervention.

The first types of territorial policies were pursued in the 1940s, mainly based on the watershed management model of the Tennessee Valley Authority. Although limited in geographical scope, already at the time these policies generated tensions with some other state and municipal authorities. Growth poles became the dominant concept in territorial policies in the 1950s and 1960s, in the framework of developmentalism, which was a dominant approach at the time, complemented by regional planning agencies and other initiatives.

Since the early 1980s, during the era of market liberalization and deregulation, endogenous and local economic development approaches have emerged as the most influential territorial policies, supplemented by decentralization processes and initiatives to bolster territorial competitiveness. In more recent years the rise of cluster-based policies and regional innovation system can be observed.

Finally, during the last decade, mechanisms like citizen participation, social dialogue and territorial pacts have emerged. Moreover, the concepts of interregional solidarity, partnership and cooperation between regions have inspired new ways of planning and territorial governance. In addition, policy coherence and the interaction with the physical environment to enable the achievement of sustainable development goals became more prominent.

This brief overview of territorial policies shows that over the decades a large and valuable body of experience has accumulated regarding public intervention to address socio-spatial inequalities. However, planning at the sub-national level in real terms often resulted in isolated and localized exercises that prevented policy coordination and evaluation, rather than in the formation of management systems that were integrated into national processes. Moreover, the planning methodology was often outsourced to specialized consulting agencies which limited the development of organizational learning processes embedded in the local communities. Given these considerations, the overview of current territorial policies in Amazon countries shows a mixed picture, including the revamping of past concepts such as growth poles.

Constitutional reform and territorial organization

Since the late 1980s, in the context of the consolidation and deepening of democratization, constitutional reform processes have been implemented involving new forms of territorial organizations. Brazil's 1988 constitution is a case in point, establishing many forms of

direct popular participation and creating the new states of Amapá, Roraima and Toncontins. Also the new constitution of Colombia in 1991, called the human rights constitution, led to the creation of the Colombian Amazon territories referred to in this chapter.

In some cases, such as Ecuador and the plurinational state of Bolivia, the new constitutions are based on concepts that aim at guiding new development styles, such as the Good Life and Good Living, which in turn permeate all government policies, including the territorial organization. A specific dimension of these trends is related with decentralization, which in some cases raises new forms of territorial organization. Three specific examples are the national plans for decentralization of Peru, Bolivia and Ecuador.

The decentralization process in the region since the 1980s has known several ups and downs. Its origin is not rooted in the principle of subsidiarity as is the case in the European Union, as expressed in the Treaty of Lisbon, where it reflects the conviction that decisions should be taken at the level closest as feasible (from the perspective of efficiency and governance) to the citizen. Decentralization in Latin America was first of all a response to the fiscal crisis and implied the transfer of responsibilities and not necessarily financial resources to local levels of government. Re-centralization followed upon the predictable occurrence of fiscal crisis at the level of local governments that even threatened stability at the national levels. A third stage is under way in which decentralization of competences and resources go together with the deepening of democracy and the strengthening of monitoring, control and evaluation mechanisms at the national level. Since the end of 2000 legislative initiatives have been successfully adopted to strengthen the sub-national units and to decentralize new functions. In this stage partnerships and cooperation agreements between territorial units are encouraged and may lead to the formation of macro-regions.

Reconstruction or reorganization of regional planning agencies

A second important institutional development relates to the reconstruction or redesign of national planning agencies during the 2000s. In several cases this process involved the renovation of planning institutions created at the beginning of the 1960s. Cases in point are the National Strategic Planning Centre (CEPLAN) of Peru, created in 2008, and the National Secretary of Planning and Development (SENPLADES) of Ecuador, created in 2004. In other cases, including Brazil, new institutions were created that more directly address the problem of regional and territorial development, such as the Ministry of National Integration, created in 1999 and the Ministry of Cities, created in 2003.

Other countries maintained continuity in the planning agency, such as the National Planning Department (DNP) of Colombia. In the context of these processes of institutional renewal the territorial dimension of development has taken centre stage as a specific aspect of planning and design of government policies.

Community participation

One of the features of the new generation of territorial development policies is the incorporation of mechanisms for citizen participation. In today's society it is critical to take the voice of the population in governance processes into consideration. Traditional methods of participation in local and regional policies were often limited to councils with representation of trade unions or civil organizations. From the seminal experience of the participatory budgeting process in Porto Alegre, many policies at local and regional levels nowadays incorporate progressively broader and more direct forms of participation in the prioritization of public action. This dialogue between civil society, state and market has led to the signing of territorial pacts, in some cases called local covenants, following examples in the European Union in the 1990s.

Territorial foresighting

A new form of territorial policies relates to the use of foresight techniques to identify future scenarios. Foresighting territorial development is a distinct and complementary approach to strategic planning and a powerful tool for building a collective vision of the future. It therefore fits well in an inclusive and participatory model that incorporates preferences and aspirations of the community as outcomes of the planning exercises. In Ecuador, under the Living Well plan, the prospective approach has permeated in provincial and local strategies through institutions such as the Centre for Strategic Foresight (CEPROEC) of the National Institute of Advanced Studies. In Colombia and Brazil, the prospective approach of development planning has been applied on various occasions in the development of state and departmental plans.

Special funds and specialized agencies

Another specific embodiment of territorial politics are national development funds for territorial development. The driving factor behind this approach is that territorial development, particularly in backward areas, is not an automatic process but requires special support. Many funds are based on the European experience of structural funds.

The funds are used especially in Bolivia and Brazil, which are intended to promote activities either in all territories, such as the National Fund for Regional Development in Bolivia, or in some special areas such as the Constitutional Fund for Financing the Northeast and the Development Fund of the Amazon in Brazil. These funds support a wide range of activities, from investment initiatives to promote entrepreneurship. In Brazil, the funds are linked to specialized agencies, such as the Northeast Development Superintendence (SUDENE) and the Superintendence for the Development of Amazonia (SUDAM) public agencies.

Two types of agencies can be distinguished. The first type has enforcement powers to identify objectives and selection criteria, with funding and technical skills of analysis, implementation and evaluation of projects in a wide range of activities. This type of institutions has largely originated from the historical experiences of the Cassa per il Mezzogiorno (Italy) of 1950, the former SUDENE of 1959, and the Corporación Venezolana de Guyana (CVG) of 1960. A second type of agencies are the catalytic agents such as investment agencies, involved in the promotion of the territory by means of territorial marketing, formulation of development agendas and the articulation of public and private actors. They are usually inspired by European regional development agencies.

Regional development policies

The territorial dimension of development is receiving more attention in national development strategies, plans and policies. Brazil has just launched the second phase of the National Policy for Regional Development; Ecuador has included a National Spatial Strategy and National Decentralization Plan in the National Plan for Good Living; Peru has incorporated a strategic axis labelled regional development and infrastructure in the 2021 Bicentennial Plan and in the National Decentralization Plan; Bolivia has adopted the Framework Law of Autonomy and Decentralization; Colombia has identified the axis of Convergence and Regional Development in the National Development Plan 2010-2014. The main elements of these plans and strategies are summarized in Table 2.2.

All these plans highlight the importance of achieving sustainable development by seeking to harmonize economic and social development with sustainable management of natural resources. Still, these policies differ in important nuances and emphasis. In Colombia and Peru, for example, investment in infrastructure is explicitly prioritized as expressed in proposals for integration through development corridors. In Ecuador, the emphasis is on diversification of the structure of production. Bolivia highlights the strengthening of the autonomy of local authorities.

Table 2.2 National strategies for the integration of the Amazon

Brazil		Ecuador	Peru	Colombia	Bolivia
National Policy for Regional Development (PNDR II)	National Plan for Good Living National Territorial Strategy (ETN)	2021 Bicentennial Plan	National Development Plan 2010-2014: Strategic Axis 5	National Development Plan 2006-2015	
Autonomy, Decentralization, Coordination, Cooperation. Equity, cohesion, interregional solidarity.	Interterritorial Equity, territorial cohesion. Polycentric and plurinational state	Regionalization for a balanced and integral development	Territorial convergence	Autonomies	
Integration Ministry, Desenvolvimento de Amazonia (SUDAM)	National Secretariat for Planning and Development (SENPLADES)	National Centre for Strategic Planning (CEPLAN) Ministry of Economics and Finance	National Planning Department (DNP)	Ministry of Planning (MIDEPLAN) Ministry of the Autonomies	

Brazil	Ecuador	Peru	Colombia	Bolivia	National goals
<p>i. Sustain a path of reversal of inter and intraregional inequalities, valuing endogenous resources and cultural, social, economic and environmental specificities;</p> <p>ii. Create conditions for a fairer and more balanced access to public goods and services in the territory, reducing inequalities in opportunities linked to place of birth or residence.</p>	<p>1. Promote a polycentric, articulated and complementing structure of human settlements.</p> <p>2 Promote the Good Life and food sovereignty in rural territories.</p> <p>3. Prioritize efficient infrastructure for mobility, connectivity and energy.</p> <p>4. Guarantee sustainability of natural heritage through rational and responsible use of natural resources.</p> <p>5. Strengthen diversity and cultural heritage.</p> <p>6. Promote strategic and sovereign insertion in the world economy and promote Latin-American integration.</p> <p>7. Consolidate a model of decentralized management based on coordinated planning and participatory management of the territory.</p>	<p>Promote decentralized development of productive and social infrastructure in order to obtain a balanced occupation of the territory and the competitiveness of regional productive activities.</p>	<p>Reduce social inequalities, improve quality of life of the population and mobilize endogenous development capabilities, making use of positive agglomeration effects to achieve higher growth and regional competitiveness.</p>	<p>Build a new model of a plurinational, autonomic and community-based state</p>	

	Guidelines for development of the Amazon	Financial instruments
<p>Brazil</p> <p>Amazonas Regional Development Plan. Accelerate economic growth of the legal Amazon with better income distribution and environmental sustainability. Four challenges: a) increase retention of positive externalities of investment; b) Intensify intra-Amazon economic and commercial transactions c). Promote structural change with competitiveness and sustainability in the Amazon d) Promote social and productive inclusion in the Amazon</p>	<p>Bolivia</p> <p>The 2009 constitution establishes that the Bolivian Amazon is a strategic space for special protection for the integral development of the country. The state will prioritize the integral and sustainable development of the Bolivian Amazon, through an integral, participatory, shared and equitable management of the Amazon rainforest. Its administration will be aimed at employment and income generation for the inhabitants in a framework of environmental protection and sustainability.</p>	<p>National Fund for Regional Development</p>
	<p>Colombia</p> <p>Achieve sustainable and converging levels of growth and social development, acknowledging and benefiting from different social, economic, environmental and institutional capabilities and regional development initiatives.</p>	<p>General System of Royalties Science, Technology and Innovation Fund, Regional Development Fund and Regional Compensation Fund</p>
	<p>Peru</p> <p>National goal: conservation and sustainable exploitation of natural resources and biodiversity with an integrated ecosystem approach and in an environment that promotes good quality of life for people and the existence of healthy and viable ecosystems in the long run</p>	<p>Royalties from mining and exploitation of oil, fishing and forestry resources</p>
	<p>Ecuador</p> <p>Goal 7: Guarantee the rights of nature and promote territorial and global environmental sustainability. Strengthen environmental governance and integral planning for the Amazon</p>	<p>Pluri-annual investment fund</p>
<p>Amazon Development Fund</p>		

One of the major concerns surrounding regional development is the issue of funding of local governments. In Bolivia, Peru, Ecuador and Colombia, funding of regional and local development is increasingly obtained from royalties from the exploitation of natural resources such as oil, gas, gold and bauxite. This arguably creates a perverse incentive to exploit natural resources at a higher pace than may be warranted from the perspective of sustainable development.

Concluding remarks

The role of local governments has been strengthened in all countries of the Amazon during the last two decades. The appearance of this relatively new agent in the context of planning for sustainable development may give rise to hope as it may bring the theme of the governance of sustainable development closer to citizens. Ultimately, the inhabitants of the region have the highest stake in the sustainable development of the area. This chapter has focused on the first level of sub-national governments in five countries and has presented the heterogeneity of cases and the diversity of situations. It has also highlighted the increasing priority that national governments attach to the issue of a geographically more balanced pattern of development and the integration of the Amazon and other remote areas in the national economy. Several distinct approaches are being explored, ranging from the granting of degrees of autonomy and recognizing the rights of nature to ambitious investment programmes to improve physical connectivity. Clearly, sustainable development planning in the Amazon is of increasing complexity, and the coordination across sectors, levels of government and among countries is quickly becoming a major challenge.

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Annex Table 2.1 Amazon territories: basic indicators – population and GDP

Territory (country acronym and year of creation of entity)	Area (km ²)	Population 2010 (number of people)	Population density (Hab / km ²)	2010 GDP (US\$)	2010 GDP per capita (US\$)	GDP density (GDP/km ²)	GDP per capita growth rate %
Acre (BR, 1962)	152 581	692 880	4.54	5 142	7 421	33 699	4.00
Amapá (BR, 1988)	142 814	658 690	4.61	5 098	7 740	35 698	2.81
Amazonas (BR, 1889)	1 570 745	3 499 275	2.23	33 193	9 486	21 132	3.35
Maranhão (BR, 1889)	331 983	6 349 721	19.13	26 864	4 231	80 918	4.53
Mato Grosso (BR, 1977)	903 357	2 966 275	3.28	35 212	11 871	38 979	4.00
Pará (BR, 1889)	1 247 689	7 394 980	5.93	47 177	6 380	37 811	2.79
Rondônia (BR, 1981)	237 576	1 619 010	6.81	13 823	8 538	58 185	1.75
Roraima (BR, 1988)	224 298	427 808	1.91	3 864	9 031	17 226	2.76
Tocantins (BR, 1988)	227 620	1 386 775	6.09	10 479	7 556	46 038	5.34
Beni (BO, 1842)	213 564	445 234	2.08	570	1 281	2 671	2.10
Pando (BO, 1938)	63 827	81 160	1.27	184	2 270	2 887	0.78
Santa Cruz (BO, 1561)	370 621	2 785 762	7.52	5 360	1 924	14 464	1.39
Amazonas (CO, 1991)	109 665	72 017	0.66	201	2 794	1 835	2.04
Caquetá (CO, 1991)	88 965	447 767	5.03	1 201	2 683	13 505	2.40
Guanía (CO, 1991)	75 238	38 328	0.51	96	2 515	1 281	0.78
Guaviare (CO, 1991)	53 460	103 307	1.93	255	2 473	4 778	-0.93
Putumayo (CO, 1991)	24 885	326 093	13.10	1 413	4 332	56 767	3.94
Vaupés (CO, 1991)	54 135	41 534	0.77	75	1 801	1 382	0.87
Morona Santiago (EC, 1952)	25 690	137 254	5.34	280	2 043	10 917	3.05
Napo (EC, 1959)	13 271	102 775	7.74	453	4 411	34 159	1.47
Orellana (EC, 1998)	20 773	120 781	5.81	5 704	47 224	274 573	2.26
Pastaza (EC, 1959)	29 520	81 417	2.76	737	9 046	24 950	0.54
Sucumbíos (EC, 1989)	18 612	177 561	9.54	4 607	25 944	247 506	-2.07

Territory (country acronym and year of creation of entity)	Area (km2)	Population 2010 (number of people)	Population density (Hab / km2)	2010 GDP (US\$)	2010 GDP per capita (US\$)	GDP density (GDP/km2)	GDP per capita growth rate %
Zamora Chinchipe (EC, 1953)	10 556	88 778	8.41	199	2 240	18 837	1.65
Amazonas (PE, 1832)	39 249	413 314	10.53	891	2 156	22 706	5.17
Loreto (PE, 1866)	368 851	983 371	2.67	3 072	3 124	8 329	3.25
Madre de Dios (PE, 1912)	85 300	121 183	1.42	881	7 272	10 331	4.13
San Martín (PE, 1906)	51 253	782 932	15.28	1 865	2 382	36 382	4.90
Ucayali (PE, 1980)	101 830	464 875	4.57	1 528	3 288	15 009	3.24
Amazon Peru	646 483	2 765 675	4.28	8 238	2 979	12 742	
Amazon Brazil	5 038 663	24 995 414	4.96	180 852	7 235	35 893	
Amazon Ecuador	118 422	708 566	5.98	11 979	16 907	101 159	
Amazon Colombia	406 348	1 029 046	2.53	3 242	3 150	7 978	
Amazon Bolivia	648 012	3 312 156	5.11	6 115	1 846	9 437	
Total Amazonas	6 857 928	32 810 857	4.78	210 426	6 413	30 684	
Latin America and the Caribbean	20 345 037	618 705 774	30.41	4 945 076	7 993	243 061	

Annex Table 2.2 Amazon territories: basic social development indicators

Territory	Male head of household. Years of schooling	Female head of household. Years of schooling	Head of household. Years of schooling	Access to sewage system (%)	Access to drinkable water (%)	Poverty (%)	Employment (%)
Acre (BR)	6.19	7.10	6.50	21.0	74.9	40.3	97.5
Amapá (BR)	7.48	7.91	7.66	4.7	85.6	41.1	91.6
Amazonas (BR)	6.90	7.56	7.16	28.8	83.7	43.1	94.9
Maranhão (BR)	4.94	5.70	5.24	16.6	72.8	44.6	97.1
Mato Grosso (BR)	7.09	7.43	7.19	20.3	96.0	8.9	96.4
Pará (BR)	5.73	6.97	6.17	7.9	76.9	43.8	95.7
Rondônia (BR)	6.39	6.95	6.60	2.9	92.2	27.4	98.4
Roraima (BR)	7.45	8.62	7.95	13.6	92.9	31.8	93.8
Tocantins (BR)	6.09	7.53	6.63	15.8	88.5	35.2	96.7
Beni (BO)	8.89	7.68	8.59	11.2	22.4	47.4	99.0
Pando (BO)	9.43	8.53	9.31	22.9	44.1	35.3	100.0
Santa Cruz (BO)	8.83	6.84	8.34	22.5	30.2	45.7	97.7
Amazonas (CO)							
Caquetá (CO)	5.62	6.34	5.81	56.9	61.7	41.7	95.9
Guanía (CO)							
Guaviare (CO)							
Putumayo (CO)							
Vaupés (CO)							
Morona Santiago (EC)	6.66	7.53	6.89	43.7	44.6	59.9	99.1
Napo (EC)	9.54	8.27	9.26	46.0	42.9	37.4	100.0
Orellana (EC)	7.03	6.07	6.96	16.2	18.0	50.5	99.6
Pastaza (EC)	7.27	6.56	7.06	75.2	63.6	53.7	96.8
Sucumbíos (EC)	7.56	6.68	7.36	58.8	41.4	42.7	99.1
Zamora Chinchipe (EC)	6.98	6.83	6.95	35.9	33.8	38.9	100.0
Amazonas (PE)	6.87	4.76	6.53	37.7	40.0	44.4	92.6
Loreto (PE)	8.40	7.68	8.28	37.1	42.5	47.6	90.3
Madre de Dios (PE)	9.30	8.38	9.11	26.3	53.2	4.2	90.7
San Martín (PE)	7.99	6.62	7.77	36.8	58.1	30.6	91.5
Ucayali (PE)	8.82	8.22	8.67	27.4	63.0	13.5	89.5

Territory	Male head of household. Years of schooling	Female head of household. Years of schooling	Head of household. Years of schooling	Access to sewage system (%)	Access to drinkable water (%)	Poverty (%)	Employment (%)
Brazil	7.12	7.26	7.17	54.9	94.2	20.9	96.2
Bolivia	8.31	6.84	8.02	41.8	39.1	42.3	89.0
Colombia	7.58	7.50	7.56	73.3	84.1	34.1	94.6
Ecuador	8.11	7.33	7.91	63.4	68.4	35.3	94.6
Peru	9.10	8.76	8.90	59.3	68.6	27.6	84.3

HUMAN ACTIVITY AND THE FUTURE OF ECUADOR'S AMAZON REGION: ECONOMIC DIVERSIFICATION, INFRASTRUCTURE AND EMPLOYMENT

ROB VOS¹

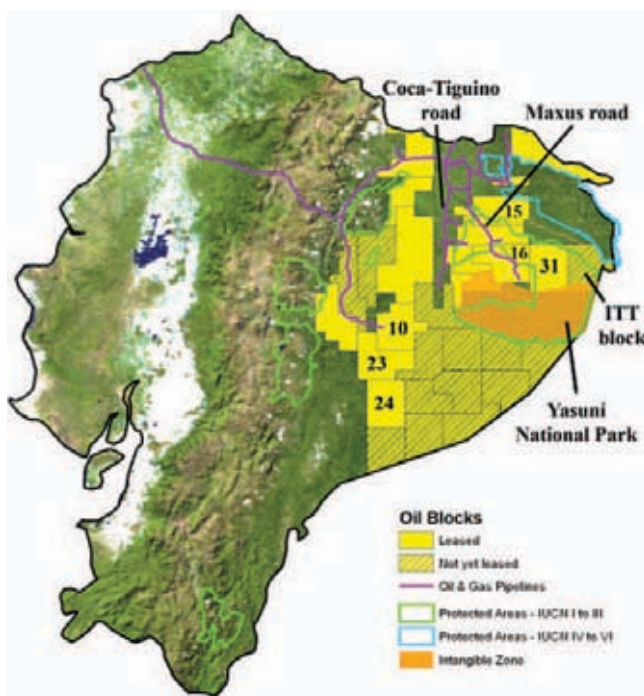
Introduction

The Ecuadorian Amazon possesses one of the richest reserves of biodiversity in the world (Myers et al. 2000 and FAO-UNDP-UNEP 2011). In the same region rich oil reserves are situated. The discovery of oil and the introduction of agrarian reform policies that have promoted agricultural colonization in the Amazon region have been driving forces behind one of the highest rates of deforestation of any Amazonian nation from the late 1960s onwards.

Significant flows of migrants have been attracted by the new economic opportunities, created by the oil industry and access to new land, and have contributed to an increase in population density in the region, be it at levels that are much lower than elsewhere in Ecuador. New road construction has facilitated population mobility and the creation of urban centres. The livelihood of the traditional indigenous inhabitants has come under threat. Recognition of the rights of indigenous peoples and concerns over the accelerated depletion of the rainforest and reduced biodiversity have induced the creation of

1. This text was written in the author's personal capacity; the views and opinions expressed here do not necessarily reflect those of the FAO or its member states.

Map 3.1 Overlaps in territorial concessions for oil exploitation, forest conservation and control by indigenous populations in the Amazon region.



Source: <http://static6.businessinsider.com/image/515499a8eab8eaac5a000000-960/ecuador.jpg>.

protected indigenous territories and natural reserves in the 1980s. In practice, however, those areas are not fully protected from the destructive forces and increased human activity. Conflicting claims over land use and between economic and human rights have continued, as shown in Map 3.1 which depicts overlapping areas conceded for oil exploitation, forest conservation and control by indigenous populations.

The creation of protected territories did slow down the opening of new areas which, in turn, increased pressure on land already in use for crop cultivation and livestock. During the 1990s, the average size of rural plots nearly halved as a consequence of limits to further expansion of the land frontier, in-migration and high fertility rates. Agricultural productivity and average farm incomes are relatively low, in part because land in the Amazon region is generally fragile and the quality of the soil is poor. Thus, an increasing number of rural households is looking for non-agricultural sources of income and moving closer to urban centres in the region or other parts of the country. However, this has not stopped deforestation and further

depletion of natural resources. As a large part of the population surplus in traditional frontier areas in the Ecuadorian Amazon has moved to less occupied or unoccupied areas near townships, this has stimulated deforestation. Long-settled river towns are expanding, new pioneer urban areas have developed, and incipient rural communities have acquired urban characteristics because of population growth and the development of basic infrastructure. Economic and social articulation is also evolving between larger and smaller urban communities, creating a growing and complex network of urban settlements in the Amazon. Urban growth and expansion of rural townships have taken place without commensurate improvements in infrastructure. The road network has become denser but the development of other basic infrastructure such as sanitation, garbage disposition, water treatment, and access to health and family planning facilities has been lagging behind. In this context, it is of interest to study patterns of economic diversification, especially into non-oil and non-agriculture activities that may limit undue pressures of expanding human activity on the region's biodiversity.

This chapter presents recent patterns of employment and income diversification in rural areas of Ecuador's Amazon region, locally referred to as the Oriente, and assesses to what extent present livelihood strategies, that are transforming rural communities in the region, also bear the potential of reducing human's impact on the rain-forest and its environmental treasures.

Employment, poverty and rural development in Ecuador's Amazon region

Structural change and economic growth

Traditional development theory puts industrial development at the centre of modern growth and development. Generally it has been assumed that the modern sectors would develop in urban areas supported by resource transfers – both labour and savings – from productivity growth in rural agriculture. Such a process has taken place to some degree in Ecuador, be it that growth was highly unbalanced (Vos 1987 and 1988). Moreover, substantial non-agricultural activities have developed in rural areas: such activities contribute almost half of rural household incomes (Elbers and Lanjouw 2001, and Vasco and Vasco 2012).

This is not dissimilar to what is found in other parts of Latin America. On an average, non-agricultural activities are the source of 40 per cent of rural household incomes and 35 per cent of rural employment (Haggblade et al. 2010). As hypothesized in the introduction, activities outside agriculture, or at least any activity minimizing

pressure on the fragile biodiversity and natural resources of the Amazon rainforest, may play a key role in support of sustainable development in the future.

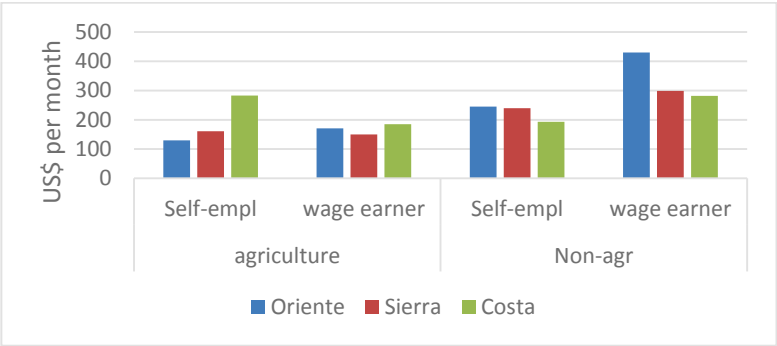
The development of non-agricultural activity in rural areas is generally explained by a combination of pull and push factors. Pull factors include opportunities for higher value added and improved incomes in non-agriculture, especially when comprising more dynamic sectors like mining, industry and tourism, which in turn provide stimulus to local economies by demanding inputs and providing services (Reardon et al. 2006). Improved infrastructure like roads, telecommunications, electricity and water tends to be critical to the development of higher value added economic activities in rural areas, not only by facilitating production but also access to urban and international markets, technology, and information.

Push factors may include both strong agricultural productivity growth and the lack thereof. As put earlier, dynamic development experiences have built on substantial improvements in agricultural productivity allowing for movements of labour and capital into non-agriculture. In contrast, poverty traps have emerged when push factors were formed by persistent low productivity, lack of access to natural resources, erosion of soils or pollution of waters, exposure to unfavourable weather conditions and other types of risks that may affect agricultural production. If such push factors are not accompanied by positive pull factors, people are likely to migrate to cities rather than to start off-farm rural businesses or to find gainful employment locally. Instead, they may add to a growing army of impoverished urban informal sector workers.

The growth of non-agricultural activity in Ecuador's Amazon area has been caused by a mix of push and pull factors, opening a pathway out of poverty for most of those that manage to find employment in such activities. At the same time, productivity has remained low in agriculture including crops, livestock, fisheries and forestry, trapping many of the farmers in the region in continued poverty.

The Ecuadorian part of the Amazon has some particular features. Since the early 1970s it has become an economically significant region as most of the country's principal source of wealth, crude oil, has been extracted there. From the 1960s, it has also become an area for expansion of the land frontier following a series of major land reform and colonization laws, which in particular facilitated the opening of the rainforest for new settlers engaging in farming for local and domestic markets as well as export cash crop farming including palm oil and extensive livestock. Gold mining has taken place for centuries in the southern part of the region, but was in decline until the 1980s when attempts were made to attract foreign investors. Large-scale mining co-exists with small-scale (artisanal)

Figure 3.1 Mean rural labour incomes by geographic region, 2010 (monthly income per worker in US\$)



Source: Vasco and Vasco 2012, based on INEC, *Encuesta de Empleo, Subempleo y Desempleo*, ENDEMU, 2010.

Table 3.1. Employment structure in rural areas, in percentages, 2010

	Agriculture		Non-Agriculture	
	Self-employed	Wage earners	Self-employed	Wage earners
Costa (coastal region)	32	36	12	20
Sierra (highlands)	53	13	10	24
Oriente (Amazon region)	53	11	9	27
National	46	20	10	23

Source: Vasco et al. 2014, based on INEC, *Encuesta de Empleo, Subempleo y Desempleo*, ENDEMU, 2010.

extraction. The sector has been a source of some continuous controversy since the 1980s with conflicts between the government and foreign investors over royalties and environmental damages, and with local indigenous populations affected by contamination and crowding out of livelihoods. Yet, as a source of economic growth and employment, the sector remains small, contributing less than 1 per cent of GDP and employing about 7,000 workers. At less than 120 km from the capital city of Quito, Ecuador’s Amazon area has always been relatively easy to reach, and particularly since the improvement of road infrastructure from the 1990s onwards tourism has grown. The combination of these factors has resulted in a relatively high proportion of rural off-farm activity in the Oriente.

Low agricultural productivity

The expansion of Ecuador's land frontier into the Amazon region did not increase labour productivity. On the contrary, the region's agricultural productivity is much lower than in other parts of the country. As indicated in the introduction, lower farm productivity in the Amazon is associated, inter alia, with poorer soil quality typical of tropical rainforests. These conditions result in significantly lower average household income among self-employed farmers in the Oriente. See Figure 3.1. It is probably also a push factor for Amazon settlers to seek non-agricultural employment and explains the low share of agricultural wage labour. See Table 3.1.

Despite being the least densely populated region, most of the more fertile land is in use and, as indicated in the introduction, further opening of land would accelerate deforestation and result in undue and unsustainable pressure on fragile soils. The creation of protected territories has increased pressure on land already in use. Landholdings remain larger than elsewhere – especially when compared with the highlands where smallholder farming predominates – but the average size of plots decreased substantially: from 45.9 hectares in 1990 to 25.3 hectares in 1999. The limits to continued expansion of the land frontier, in-migration and high rates of fertility are main determinants behind this trend (Barbieri et al. 2003). Despite growth of non-agricultural activity, this trend has also kept the share of self-employed farmers at a level of more than half the rural work force in the Oriente, while the availability of jobs for agricultural wage earners is limited.

Dispersed development of non-agricultural sectors

Rural non-agricultural enterprises tend to concentrate in or near villages well provided with infrastructure like roads, electricity, telecommunications and basic services. This applies to rural Ecuador in general and the Amazon area in particular. Vasco (2011) and Vasco and Vasco (2012) find that rural non-agricultural enterprises are more likely to be run by households whose members have more education, experience, and wealth (unless when owning land). The same factors also influence opportunities for non-agricultural wage employment. Belonging to the indigenous population does not appear to influence the likelihood of being employed in non-agriculture. However, it is probable that ethnicity is of influence indirectly, given that indigenous populations tend to be more disadvantaged than other groups in Ecuador in terms of education, wealth and access to basic infrastructure. The econometric estimates in Table 3.2 may have picked up that effect in the corresponding variables.

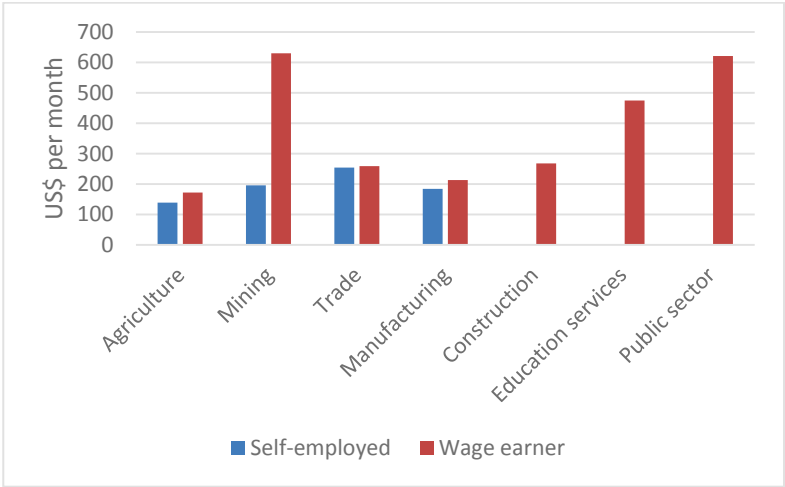
Table 3.2. Determinants of rural employment in non-agricultural activities, 2010 (multinomial logit model, marginal effects)

		Nation-wide (rural)		Amazon region	
		Self-employed	Wage earner	Self-employed	Wage earner
Experience	Age	0.003**	0.008***	0.012***	0.009
	Age squared	-0.000***	-0.000***	-0.000***	-0.000**
Sex	Female	0.014*	0.087***	0.073***	0.022
Education	Schooling	0.021***	0.002***	0.000	0.035***
Ethnicity	Indigenous	0.065	-0.010	-0.031	0.001
	Afro-ecuadorian	0.074	-0.011		
	Montubio	-0.069***	-0.037***		
	White	0.018	0.028	-0.034	0.151
Household characteristics	Household size	0.000	-0.004***	-0.000	-0.012*
	Wealth index	0.029***	0.020***	0.018***	0.050***
	Access to land	-0.132***	-0.070***	-0.093***	-0.277***
Infrastructure (district level)	Electricity	0.368***	-0.010	0.405	-0.258
	Telephone	0.398***	0.129***	0.144	-0.275
	Roads	0.082***	0.047***	0.206	0.035
	Distance to nearest market	-0.001***	-0.000***		
Regional dummies	Costa	0.114***	0.047***		
	Oriente (Amazon region)	0.106***	0.027**		
Provincial dummies	Morona			-0.707*	-0.031
	Napo			-0.059*	-0.006
	Zamora			-0.025	-0.078
	Sucumbios			-0.037	0.073
	Orellana			-0.049	-0.092
Number of observations		16,000		823	
Wald test χ^2		6358.97***		380.16***	

Note: *, **, and *** denote significance at, respectively, 10%, 5% and 1% level.

Source: Vasco and Vasco 2012 and Vasco et al. 2014, based on INEC, *Encuesta de Empleo, Subempleo y Desempleo*, ENDEMU, 2010.

Figure 3.2 Rural labour incomes in Ecuador’s Amazon region, 2010 (monthly income per worker in US\$)



Source: Estimates based on INEC, *Encuesta de Empleo, Subempleo y Desempleo*, ENDEMU, 2010.

These findings for rural Ecuador as a whole are based on a multinomial logit model using data from the nationwide labour force survey. See the first two columns of Table 3.2. The results also show a positive intercept dummy for the Amazon region, which reflects the significantly higher share of non-agricultural rural employment.

A similar analysis by Vasco et al. (2014) for the Amazon region confirms most of these findings. However, note that the infrastructure indicators are no longer significant, but have a positive sign for non-agricultural self-employment. This does not necessarily imply that infrastructure has no tangible influence on the process of rural transformation. The district level indicators used in the study are probably too aggregate to show the variation around the scattered rural townships and relatively large urban settlements in the vicinity of which the non-agricultural activities have expanded in a dispersed fashion.

An important demographic characteristic is that women in rural areas are more likely than men to be employed in low productivity non-agricultural activities. This holds both nation-wide and for the Amazon region. The finding is consistent with other findings showing that men are more likely to out-migrate to rural areas than women, while the reverse occurs for urban areas (Barbieri and Card 2005). As compared with men, young women are more likely to out-migrate to urban areas as difficult access from farms to towns and roads constrains women’s migration, while access to new land (or lack thereof) in the Amazon is more associated with male out-migration.

Incomes in non-agricultural activities are significantly higher than in agriculture as shown in Figure 3.2. Wage labour is more lucrative than having one's own business. This is not surprising as most non-agricultural self-employment is concentrated in low-productivity micro-enterprises engaged in simple food processing or petty trade. Most wage labour is concentrated in extractive sectors like oil and gold mining, the public sector and tourism, which are more skill-intensive activities.

As may be expected, significantly higher labour incomes in non-agriculture activities reduce the likelihood of being poor for those employed in such activities. An earlier study by Elbers and Lanjouw (2001) based on data for the mid-1990s found that people living in the Oriente were much less likely to be poor when working in non-agricultural activities. When involved in relatively highly productivity activities like oil extraction or tourism, the likelihood of workers and their families being poor was 50 per cent less, and 25 per cent less in lower productivity non-agriculture activities like informal services, petty trade and simple manufacturing. In Ecuador, it is not obvious that making a living in non-agricultural employment is a secure way to get out of poverty, given that in the coastal region (Costa), the likelihood of being poor in fact increases with the share of rural employment in low productive non-agricultural activity.

Less poverty, but is the rural transformation process sustainable?

This chapter started out pointing at a 'vicious cycle' affecting the Amazon region's natural resource and biodiversity base: pressure on land is leading to deforestation in most or all areas in use for agriculture and reduces the possibility for further agricultural extensification (deforestation); out-migration, particularly by men, takes place to other rural or forested areas in the Amazon as women are more likely to prefer rural townships and urban destinations. In view of population growth and pressures in the newly settled areas, out-migration to rural destinations and unabated deforestation are likely to continue. Thus, the process of diversification into non-agricultural activity in the Amazon indeed is lifting many out of poverty but does not seem to be sustainable. For that reason such a pattern does not create an optimal future for Ecuador's Amazon region. This concern is not new at all: these problems were noticed decades ago and the alternatives suggested at the time have not taken hold. For instance, Hicks et al. (1990) already warned more than three decades ago that unchecked and unbridled agricultural expansion would cause irreversible damage to Ecuador's rainforest. The vicious cycle was already present at the time.

The alternative route involves the expansion of non-agriculture activity near rural townships and urban centres. However, that will only limit pressure on fragile Amazonian land if agricultural activity is restricted further, *inter alia* by expanding protected natural zones and by improving enforcement; by putting strict limits to livestock production and by making existing farming more productive and ecologically responsible. Regulated eco-tourism has a vast potential if it engages the local population. Moreover, infrastructure needs to be improved in the urban centres and rural townships at the entrance zones of the Amazon, by keeping up traditional means of transportation (over the rivers) into the rainforest, and by setting strict standards for new infrastructure including lodging facilities deeper into the area. The creation of farm and off-farm jobs in forestry has additional potential and is currently being promoted through the UN-REDD+ programme which in turn is supporting Ecuador's strategy to put a halt to deforestation by means of the national plan 'Buen Vivir' (FAO-UNDP-UNEP 2011).

The economic transformation of Ecuador's Amazon area is continuing but not sustainable in its present form. Strategies towards more sustainable transformation need to be developed and implemented urgently. If not, it will impede the opportunity of a 'Buen Vivir' for present and future generations in the region, as well as for many living outside the region and beyond Ecuador's borders because of irreversible loss of biodiversity and its possible impact on climate change.

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SPATIAL IMPLICATIONS OF NEW ROAD INFRASTRUCTURE FOR THE USE OF LAND AND RESOURCES IN SURINAME: LAND USE SCANNER

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Introduction

Plans to develop road infrastructure to connect Suriname with Brazil have been on Suriname's policy agenda for several decades. These plans have been designed as a vital component of the country's strategy to diversify domestic energy supply by means of hydro-energy. The diversion of the waterflow of the Tapanahoni River and Jai Kreek, the so-called TapaJai Project, would contribute to the hydro-energy potentials of the Brokopondo storage lake in the north of the country and create the opportunity for the construction of additional small hydro-power stations in the forests south of the Brokopondo storage lake. To facilitate the construction of dams, canals, power plants and high voltage lines, roads are required to reach these construction sites from the north. In addition, the ambition to develop the port of Paramaribo as a transit port for northern Brazil has resulted in the plan to construct a connection between Paramaribo and

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the Brazilian border in the vicinity of Vier Gebroeders. It is Suriname's intention to realize a road corridor between Paramaribo and Manaus, a major industrial centre in the heart of Amazonia at the Amazon River.

So far the southern part of Suriname's interior has been inaccessible over land. The only types of transportation in the interior are small boats and small planes. Construction of a new road would open up the country's forest areas, increase accessibility of natural resources such as timber and mining products, and would seriously impact upon the livelihood of indigenous peoples, particularly those living along the Tapanahoni River in the very south of the country nearby the border with Brazil. The plans referred to above have not yet resulted in formal decisions regarding the construction of road infrastructure. Consequently, no strategic environmental assessment (SEA) has been made concerning potential impacts of such infrastructure works on the socio-economic and environmental conditions in the potential impact area.

This chapter investigates potential spatial implications of infrastructural development plans on land use in Suriname. The study is based on earlier investigations undertaken as contributions to a research project on the impacts of interventions in the south east of Suriname. See Molendijk et al. 2013; Jolly. et al. 2012 and Van Dijck 2013. Geographical information combined with advanced land use models play a crucial role in assessing potential spatial changes in land use and resource use resulting from these infrastructural plans. The implications of such interventions for people and the environment in the potential impact areas can be demonstrated by presenting potential impacts in maps. These maps have to be accessible to the local population in the impact areas and to others. Visualization of the outcomes of modelling exercises can support awareness of impacts which may subsequently contribute to optimisation of routing and choice of transport mode, and the development of policies in relation to these infrastructure proposals and plans.

In the context of this investigation the following issues are addressed: selection and construction of geographical data required for the assessment of spatial implications on land and resources; investigation into the potentials of land use modelling to assess spatial impacts; options to make the information available to a wider audience.

The chapter is organized as follows. The next section presents some reflections on land use modelling. The third section focuses on road construction and its impact on land use, as studied by using the Land Use Scanner and applying a scenario approach. Section four analyses current land use in Suriname on the basis of available data. The next section presents modelling outcomes regarding the location of the impact area. Section six deals with techniques to make the

findings accessible to the public. Some final reflections are presented in the last section of this chapter.

Simulating the future

To model future developments, a set of maps has been constructed that displays information on population, biodiversity, qualities of the soils, current land use, physical infrastructure and other dimensions that are of significance to understand potential impacts of road construction in forested areas. These maps are essentially spatial databases that can be linked and combined by means of Geographical Information Systems (GIS) information. The collection of maps and the description of the relationships between these maps may be considered as a 'system' that can be used for simulating changes in map elements and relationships between these elements within the set of map layers. Scenarios may be developed and their impacts on 'the system' may be investigated.

Impact assessment studies of new road infrastructure commonly include geographical analyses and model applications following the classic example of Chomitz and Gray (1996). Different scenarios for impacts of a new road can be fed into the geographical system, and by running the model, we may calculate and assess possible consequences of different routings of the corridor.

Nearly all SEAs apply *ex ante* boundaries of the impact areas, in most cases related to the location of mountain ranges, wide rivers and national borders. This study, however, does not apply such *ex ante* boundaries and includes the surface of the whole country in the assessment of the potential spatial impact of a road. Indeed, potential transboundary impacts may be the object of a follow up research project.

Land use models are tools to support the analysis of the complex and dynamic relationship between causes and consequences of land use change (Verburg et al. 2004). Several types of such models exist, all with their own characteristics: static versus dynamic models, transformation versus allocation models, deterministic versus probabilistic models, sector specific versus integrated approaches and so on (Koomen and Stillwell 2007).

Land use models are based on a number of theories and methods. Koomen and Stillwell (2007) describe eight theoretical principles underpinning these models: economic theory, spatial interaction theory, cellular automata, statistical analysis, optimization techniques, rule base simulation, multi agent theory and micro simulation. Economic theory and rule based simulation are particularly significant in the study presented here.

Several elements from economic theory are particularly important for land use models: bid rent theory, discrete choice theory and the concepts of centripetal (agglomeration) and centrifugal (dispersion) forces that play a crucial role in the new economic geography put forward by, amongst others, Krugman (1998). The bid rent is the price competing land users are willing to pay for land, depending on accessibility of that area of land in terms of relative distance (Alonso 1964). The fundamental idea behind the discrete choice theory (Mc Fadden 1978) is the choice consumers have between two or more discrete mutually exclusive alternatives. It establishes the probability that a consumer or land user will choose one type of land use from a range of alternatives. It does not allow for multiple land-use changes at the same location. Agglomeration forces have been formalized in, amongst others, the cluster theory developed by Porter (1990 and 1998) which focuses on spatial aspects of allocation decisions: firms settle in the same area because of external economic advantages such as investment in infrastructure. Translated to land-use modelling as in our case study: the suitability for certain types of land use is strongly related to their current spatial distribution, because of these agglomeration forces. In rule-based simulation, known processes are imitated by feeding strict location-based rules into a model (Koomen and Stillwell 2007). This approach is particularly useful to represent physical processes that follow straightforward, deterministic cause effect chains and is, for example, used to link impact assessments to land use change models (Sheridan et al. 2007).

Road construction and impact on land use

Land Use Scanner

The Land Use Scanner is a model for analysing the effects of different scenarios on land use change. It has been applied extensively in policy-related studies including strategic environmental assessments (Koomen and Borsboom-van Beurden 2011; Koomen et al. 2011). Infrastructure development can be an important aspect of a scenario study and so are demographic growth and spatial policy options. The model is less suitable for predicting the exact location of a new road, but is very useful to project the effects of nearby new infrastructure for developments in built-up areas, agriculture, deforestation and maybe mining. The projection may take other relevant developments modelled in the scenarios also into account.

The Land Use Scanner has been developed to allocate future land use. The model is capable to (1) determine whether all future spatial demands can be satisfied simultaneously; (2) allocate and map spatial distributions with maximum suitability of land use types; and (3)

help to evaluate the impact of resulting spatial distribution, for example by means of the accessibility indicator, explained below. Clearly, the model does not predict demographic growth or commodity prices.

In the model, possible land uses compete with one another as the outcome of a certain scenario, resulting in a map that indicates for each location on the map its most suitable type of land use. Agglomeration forces influence the spatial allocation decisions since: e.g. large-scale agriculture is likely to concentrate in areas that are already in use for agricultural purposes. Thus urban space or mining locations will not likely convert to agricultural land use. An example of a rule-based simulation in the model could for instance be the establishment of a high threshold value for the probability that the land use in official nature reserves will convert in the future into large scale agricultural land use.

The Land Use Scanner is developed in The Netherlands where land use is mainly influenced by spatial planning due to the high pressure on land, but the model has recently also been applied in other countries in Europe (Te Linde et al. 2011; Hoymann 2010). The software framework and allocation algorithms applied in the model are also used in the land-use model that is currently being applied by the European Commission in policy preparation studies (Lavallo et al. 2011). Investment decisions usually have a time horizon of several years in terms of project realisations and payback time. Therefore, the model usually calculates in a dynamic way plausible changes in land use in several time steps of 10 or 15 years. In our case study, the impacts of the construction of a new road have been calculated iteratively with time steps of one year or smaller. The suitability factors are classified as dynamic as they depend on the allocated land use in the previous period, or other factors that change over the projection period. This dynamic approach enables a stepwise presentation of changes in the course of time, not only the final outcome, which gives a detailed insight into the process of land use change.

Scenario approach

On the basis of our understanding of the relations between the map elements and map layers – the geographical ‘system’ – and our designed scenarios, future effects may be calculated. As neither the functioning of the current land use system nor the factors affecting future land use are completely known, modelling future land use always involves uncertainties. A popular approach to deal with uncertainties is using scenarios. Thus, the effects of a range of alternatives regarding future land use can be assessed, based on a logical and consistent set of assumptions. These scenarios usually generate outcomes in a range of possible plausible changes in land use. In a sce-

nario approach, the focus is not so much on making the best possible forecast but on developing a consistent set of alternatives, used to communicate a specific message to stakeholders. For that reason rather extreme scenarios may be used that convey the message clearly.

Scenarios may be conceptual or more operational. Well-known conceptual scenarios like the ‘liberal market approach’ and ‘government-dominated approach’ may result in different demands for types of land use and in many parameters for suitability maps. In a ‘liberal market’ scenario, point of departure will be a certain percentage of economic growth, leading to a more unrestrained expansion of space needed for housing and work. In such a scenario, we may expect a higher degree of urban sprawl in the resulting calculations. In operational scenarios, as used in the case study presented in this chapter, only few parameters differ between the scenarios.

Road infrastructure

Road construction may have substantial and widely spread impacts on adjacent territories: it induces new claims on space for economic activities and housing, not only in the short term as a result of the construction works, but particularly because of increased accessibility of the newly opened areas (Scholten et al. 2001). Kaimowitz et al. (2002 p. 43) refer to an overwhelming amount of literature showing that forests are more likely to be cleared with a road nearby, measured in terms of distance or travelling time. Nepstad et al. (Rudel 2005 p. 62) investigate road paving in the Brazilian arch of deforestation and find that ‘whereas farmers cleared 0 per cent to 9 per cent of their land within 50 km of unpaved roads, they cleared 29 per cent to 58 per cent of the land within 50 km of paved roads.’ A road opens up previously less accessible areas of land, which stimulates various forms of economic exploitation: timber logging, mining, small-scale and large-scale agriculture and cattle breeding. Previously peripheral villages get better connections with the centre at lower costs. Consequently, land speculation is likely to flourish, and interests in concessions for timber or mining extraction will increase.

All these impacts have an important spatial dimension. Ultimately, the selected trajectory of the road will be the key factor for the allocation of spatial developments. Geographical or spatial information is needed to understand what areas will probably be affected substantially by the construction of new infrastructure. Consequently, collecting spatial data on current land uses and on plausible future trajectories of infrastructure developments was a major component of the study presented in the next sections.

Land use in Suriname

Suriname is a sparsely populated country. Its total population of about 500,000 inhabitants is mainly located in the coastal zone particularly in the city of Paramaribo and to a lesser extent in urban areas like Nieuw Nickerie and Moengo. More to the south, population density decreases, land is forested and less accessible. Traditional subsistence agricultural is predominant among the Maroon and indigenous populations in the area. Large parts of the territory are concession areas for mining and timber production or so-called domain land; gold digging is widespread, particularly in the eastern and south-eastern part of the country.

In December 2010 a memorandum of understanding (MoU) was signed between the Suriname government and the Chinese company China Harbour to construct a road and a railroad between Paramaribo and the border with Brazil nearby the village of Vier Gebroeders. The MoU refers as well to the construction of a deep-sea port. These intentions indicate at a focus on the transportation of bulk goods such as mining products and timber from Suriname's interior and possibly Brazil to the north of the country. The status of these proposals and plans is not entirely clear. Political conditions tend to fluctuate and impact upon the positioning of persons and institutions regarding these proposals and plans.

Current land use

Starting point of a spatial impact analysis is an accurate understanding of current land use. When using simulation results of spatial impacts of a new road for planning and investment purposes and to raise awareness among a broader audience, small inaccuracies in the current land use map may generate inaccurate projections and, moreover, may contribute to confusion.

A land use map of Suriname covering each relevant land use type for the case study was not available. Paper-based maps were digitized, rasterized (as the selected Land Use Model operates with spatial raster data) and reclassified to the identified relevant land use classes. Each raster cell in the map represents an area of 250 by 250 meter. At the country level, this resolution fits our research purpose best: it represents sufficient detail, and at the same time allows for fast calculations based on millions of raster cells in the model.

The following land use types were distinguished: shifting cultivation; small-scale agriculture; large-scale agriculture; irrigated agriculture (wetlands for cultivation of rice); human settlements; forest; swamp/savannah; open area; and water. Several sources of data for the new maps were used. Paper-based maps on vegetation and agriculture were provided by the Centre for Agricultural Research

(CELOS) provided important inputs for the final land use maps. A map of areas that were deforested due to mining activities was provided by WWF Guyanas. This map was used to update the CELOS vegetation map by reclassifying CELOS 'forest areas' as 'open areas' in the final current land use map. For water bodies and rivers, a base map of the former Centre for Aerial Cartography (Centraal Bureau Luchtkartering, CBL) was used in which rivers and water bodies were digitized as lines without surface. By overlapping the CELOS vegetation map with the map of water bodies, some overlapping areas were identified, and the land use type of these areas were subsequently reclassified as 'water'. Data taken from the UN Food and Agriculture Organization (FAO) were used for altitude and slope maps. FAO data were also used to establish the national boundaries of Suriname, adjusted with hand digitised demarcation of the national territory in contested border areas with Guyana and French Guyana. The cells outside the national boundaries are classified as sea or as abroad. Country totals with the number of hectares land use per type were mainly derived from data from the General Bureau of Statistics of Suriname (ABS).

As it should not be excluded on forehand that plans developed with China Harbour may have some relationship with the potentials to exploit reserves of natural resources such as iron ore, bauxite, and copper, a dataset with the locations of such resources was added to the map collection. This data set is extracted from the map of Lutchman *et al.* 2003. See also Conradi 2003 and Kranenburg 2007. Geological information was taken from the Planatlas Suriname 1988, based on Dahlberg 1975. According to Planatlas, it is not possible to extract natural resources at present in a profitable way.

The paper maps were georeferenced and digitized. No recent geological research has been published since Dahlberg 1975 (Kroonenberg 2009). In 2011 the 'One Geology Project' was started by the Surinamese Ministry of Natural Resources (NH), together with the Suriname Environmental and Mining Foundation (SEMIF) and the ADEK University of Suriname. This project focuses on the geological survey of the south of Suriname, in collaboration with the Brazilian government, and investigates potentials for exploitation of mineral resources. Resulting project data have not been published yet.

Data on concessions were derived from the Foundation for Forest Management and Production Control (SBB) and the Geological Mining Service (GMD) of the Ministry of Natural Resources.

Data on human settlements were based on Open Street Map (OSM). The premise here is that the density of road networks in OSM is directly related to human settlements: the higher the density of the road network in an area, the more probable it becomes that this area is a human settlement. The density of roads in a cell is calculated by counting points that are positioned at a regular pattern on

each road. If this number exceeds a certain threshold, the cell is classified as a settlement cell. The threshold value is based on expert knowledge and validated with Google Earth satellite data. For most cells, this procedure has resulted in accurate output. However, this procedure fails for cells in larger settlements that do not exceed the threshold (e.g. a park in a city); and for cells outside settlements that do exceed the threshold (e.g. a cross road). To include the first type of cells and exclude the last type of cells, a spatial neighbourhood operation has been added. By doing so, the score of each cell is dependent on the score of neighbouring cells: the more neighbouring cells are classified as 'human settlement', the more likely a cell should be classified as 'human settlement' too.

Since the new road will cross the forested interior, where indigenous people live without OSM coverage, another paper-based map of small villages was added to the generated OSM settlement map. This paper-based map was also provided by CELOS and verified with data on villages of the interior provided by the ABS. With this revision of OSM data, supplemented by the small-village map to cover settlements in the interior, a realistic pattern of settlement cells has been produced.

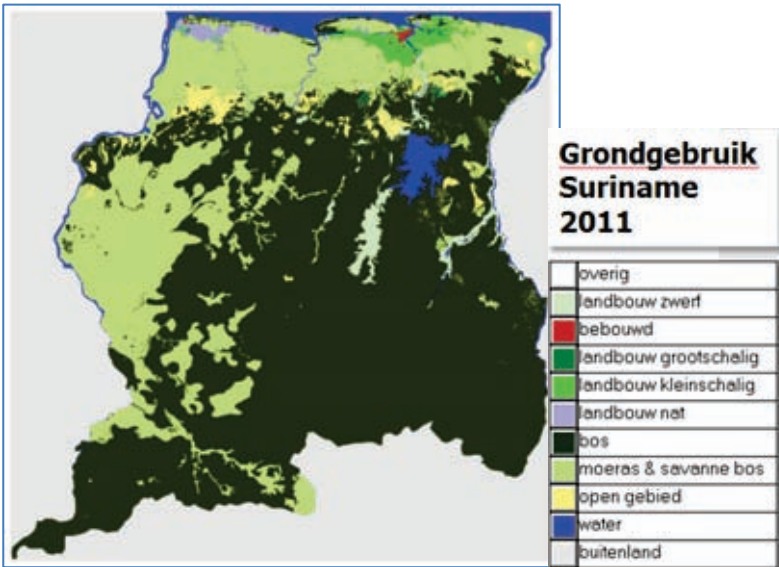
The collection of spatial data was a cumbersome process, since geo-information is considered a valuable asset for organizations owning geographical data. Moreover, data were often available in paper format requiring quite some technical expertise to transform paper maps into an accurate land use map.

The current land use map was constructed by combining all data mentioned above. Remaining raster cells – that is: cells with no land use type or value – were assigned to a certain type of land use based on the most frequently occurring types of land use in the immediate neighbourhood. The result is the land use map, presented as Map 4.1.

Infrastructure

Road infrastructure in Suriname is concentrated in the most populated areas in the coastal zone. In the last decades, the interior has been opened up gradually, particularly because of the spread of small-scale mining activities, as well as the upgrading of unpaved roads. Data on road infrastructure were derived from OSM and CELOS maps. Projected roads and new dams and water bodies were based on the plan by Boksteen (2009). To design a plausible route for the proposed road to Brazil use has been made of altitude and slope maps of FAO, in combination with the current land use map. In the design of the projected trajectory, steep inclinations of the road were avoided to the extent possible. Clearly, this projection is merely an

Map 4.1 Current land use map, 2009, Suriname



approximation of the possible future trajectory. Based on the expectation that such a road may be useful to exploit natural resources in the area such as timber and minerals, secondary roads to link the main road with locations of mineral resources were added. Combining the plan by Boksteen (2009) with the trajectory of the proposed road to Brazil results in Map 4.2 of road infrastructure developments.

Modelling the impact area

The next step is to use the Land Use Scanner in order to measure in a dynamic way the impact of the new road on adjacent territories. As the construction of a new road develops over time, the model calculates for each defined time interval the effects of the road on land use. These effects are input data for the calculation of the effects of the next time interval.

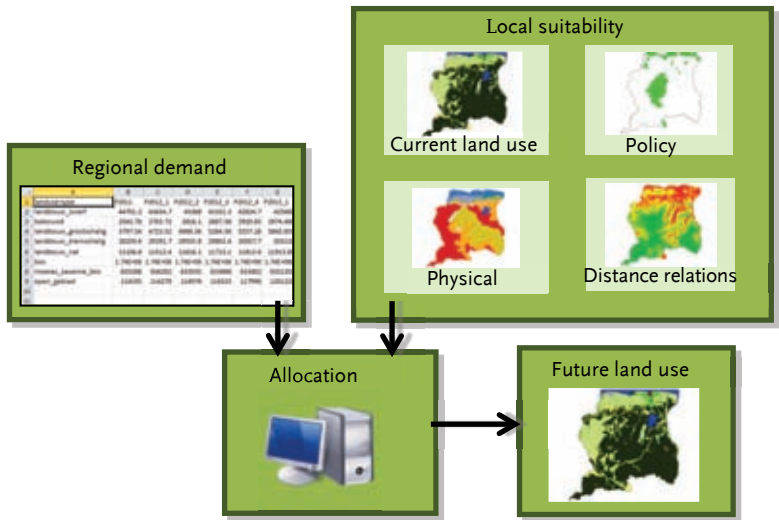
The Land Use Scanner is a GIS based model that generates spatial projections for alternative scenarios, depending on a series of variables related to land suitability, physical factors, infrastructure, markets, population concentrations and government policies. The raster cells compete with one another for the most suitable land use, based on the bid rent theory. The model is rule-based as well: based on the cluster principle, the selection of optimal land use type in a

Map 4.2. Suriname, development of road infrastructure, 2011-2025

cell is influenced by the land use type in neighbouring cells. In line with other rules the calculation of distance maps is not only based on absolute distance but also on relative distance: the time it takes to get from one location in the map to another location is determined by absolute distance, as well by the terrain conditions, such as variations in altitudes, locations of swamp areas and other variables.

So the basic assumption is that multiple land use types such as built area, agriculture, forest, nature, water, and others, compete for the same limited amount of land. Figure 4.1 illustrates the components

Figure 4.1 Conceptual scheme of the Land Use Scanner Suriname



of the Land Use Scanner and their mutual relations. ‘Regional demand’ and ‘local suitability per land use type’ determine the price a land user is ‘willing to pay’ for a specific land unit.

Regional demands are projections of the total amount of hectares necessary per type of land use for a region, or even the whole country in the future. These projections vary per type of land use. Sources for these projections can be sector or demographic models. To illustrate the point: predicted demographic growth usually results in a higher demand for built up areas and agricultural land.

In the case study, a high population scenario is used to define the demands for human settlements and agricultural land use. The demand for extra open area in the future is based on the number of kilometres the new road will cover. We expect the model to locate extra open land alongside the newly constructed road. Forest is used as a rest category, so the total number of forest cells will decrease with the increase in number of cells for human settlements, agriculture and open area.

In our case study regional demand is de facto national demand. This implies that in the annual calculations for each type of land use, only one aggregate value for the whole country is used. If more regional data would be available, the case study could be improved by regionalization of demand.

Local suitability is modelled for each type of land use at the grid cell level. It indicates how suitable a cell is for the modelled type of land use. Per individual cell the model may incorporate a large number of suitability factors referring to various aspects such as:

(1) current land use. The suitability of a type of land use for a unit of land is often higher if that type of land use already occurs in the land unit in the previous period. Especially when transition of land use involves high transition costs this factor may be a significant factor. Moreover, the presence of the same type of land use in adjacent territory also tends to increase suitability for similar used of land. A case in point is the use of land as a housing area when services are available in support of such land use in adjacent housing areas;

(2) physical properties, such as altitude, slope and type of soil. Horizontal land units at low altitudes are often relatively more suitable for built-up area, infrastructure and intensive agriculture, as construction and maintenance costs are relatively low;

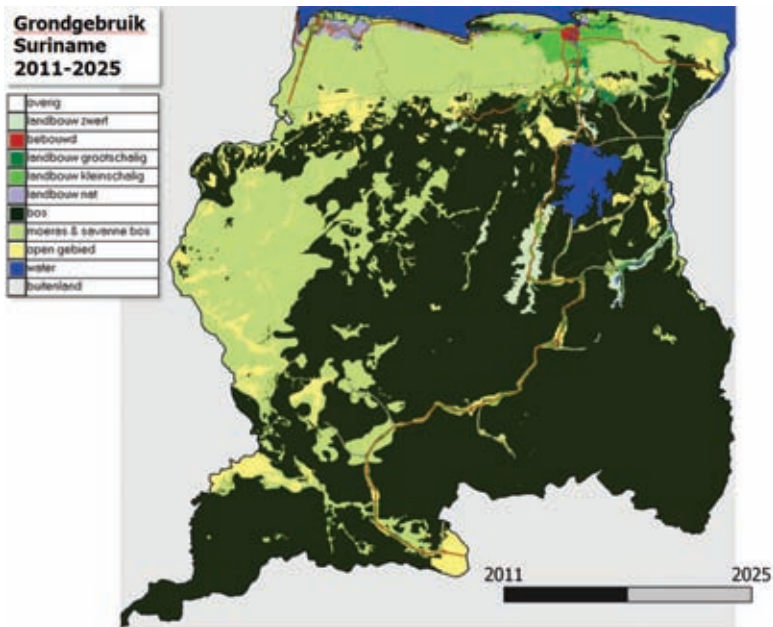
(3) planning policies, such as protected areas or concession policies and known areas where raw materials (such as gold, platinum, bauxite) are found determine to a large extent how suitable a cell is for economic exploitation and development. For example: for the suitability of human settlements and open area concessions have a positive effect; for the suitability of agriculture land use types the effect is negative.

(4) distance to towns, harbours, roads or rivers. Distance impacts upon the suitability of a cell for a particular type of land use, especially when transport costs play a significant role.

The suitability of land units is affected by nearby improvements of roads. In the Suriname case study, new roads will reduce travel time between the interior areas in the south and Paramaribo from for example 24 hours to less than 8 hours. Clearly, such road improvement may impact differently on the various types of land use, implying that some types of land use will pay higher prices per unit of land in case of improvement of accessibility. In the allocation module, these higher prices will result in the allocation of built-up area and agriculture in territories adjacent to the improved or new road, all other factors remaining the same.

The allocation module allocates the types of land use according to their local suitability, taking regional claims as preconditions that need to be fulfilled. If the claims cannot be fulfilled, status information on why no feasible solution can be found is presented. The allocation model uses a discrete allocation function, resulting in one type of land use for each unit of land. For more information on this function see http://wiki.objectvision.nl/index.php/Discrete_Allocation. GeoDMS software has been used to calculate these results. GeoDMS is a modelling framework that supports a controlled and efficient calculation process and is particularly useful for large spatial datasets. In the Surinamese case study allocation results are calculated for more than 4 million grid cells and dozens of suitability factor maps within one minute.

Map 4.3 Projected land use Suriname 2018

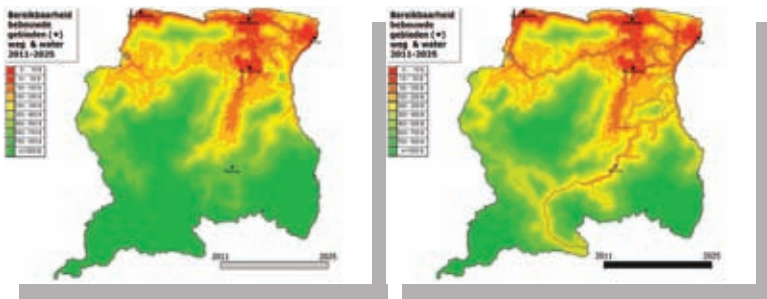


The result of the Land Use Scanner is a projection of future land use. This future situation is the result of a land use change process over multiple years. The results are generated for multiple time steps of one year or smaller, which leads to a deeper understanding of the process of land use change. Animation techniques can be used to visualize developments, using the future land use of the time steps as input. An example is Map 4.3.

The impact of the road on land use varies from low impact areas within a buffer zone of 500 meter to high impact areas with a buffer zone of four km. Differences in impact result from suitability of areas for developing settlements and agriculture, deforestation and mining.

The accessibility of large parts of the interior is strongly affected by new infrastructure and resulting land use changes. Map 4.4 shows the change in accessibility between 2011 and 2025. The green areas, nature, are less accessible. The costs involved to travel to these areas are relatively high. In 2025 large parts of the initially green areas have become yellow or orange, indicating that travel costs to reach these areas from the coastal zone will diminish substantially as a consequence of the new road.

Map 4.4 Suriname, increased accessibility of the interior towards major settlements 2011-2025



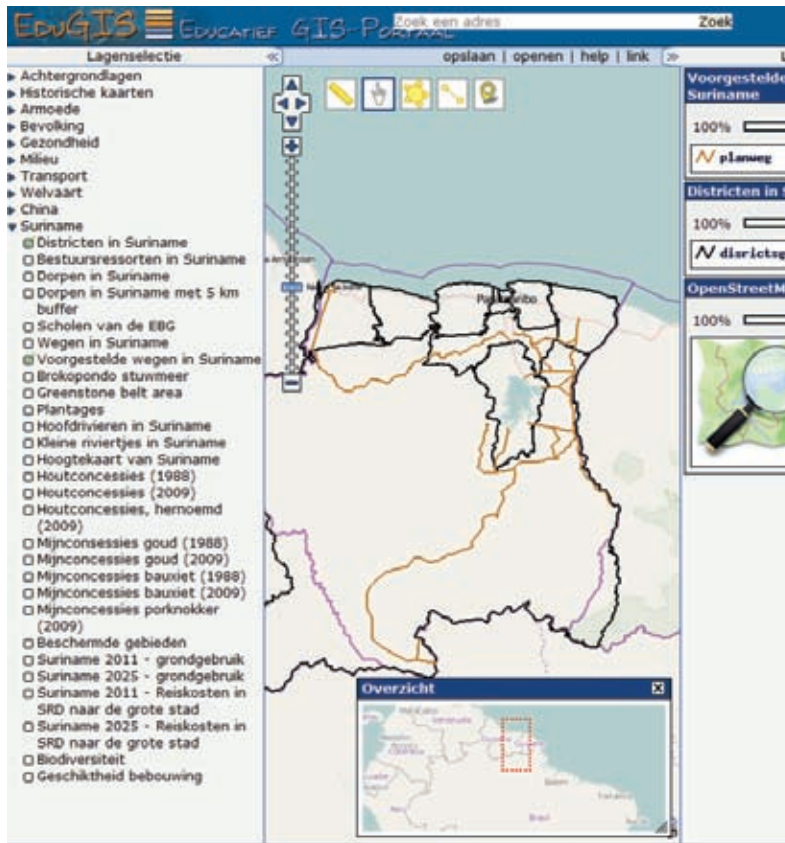
Accessibility is only one indicator to evaluate future land use. Other indicators can be added to broaden the analysis. Cases in point are assessment of impacts on carbon sequestration or biodiversity.

Making information accessible

Among the main objectives of using the Land Use Scanner in this case study is stimulation of public debate by identifying desired and undesired effects of a new road and related policies. This information is useful to technical experts involved in optimal land use planning, policy makers, locals living in the potential impact areas of roads, and other stakeholders such as investors, entrepreneurs, environmentalists and researchers. Descriptive information of the project and the resulting animations are available at: <http://www.objectvision.nl/projects/suriname-new-infrastructure>.

See also Van Dijck 2013 Chapter 8. The Land Use Scanner, including the configuration of the scenario developed with stakeholders in Suriname in 2013, is available at: <http://www.objectvision.nl/demos/land-use-scanner-training-edition-suriname>. This internet page is particularly of interest to technical users who like to experiment with the tool.

For a broader audience, mainly interested in the basic land use map, the infrastructure plans and the results of the Land Use Scanner projections, information is presented on the EduGIS website. EduGIS is a web-based GIS platform, developed for educational purposes. The information can be found at: <http://www.edugis.nl/lesmodules/Suriname>. By using this public website, everyone with an internet connection is able to consult spatial data sets, zoom in to the relevant areas, combine map layers in order to perform basic

Map 4.5 EduGIS website, Suriname section

visual analyses. This allows users to find out about the distance between proposed or planned infrastructural works and the location of villages, concessions for timber logging and (gold) mining, or areas with high levels of biodiversity. Map 4.5 distinguishes the maps collected at the left-hand side of the menu under '*lagenselectie*' (layer selection). Each map can be displayed in the screen, and different map layers can be combined, depending on the interest of the user. To explore the datasets or maps, an educational module has been developed, shown at the right-hand side of the menu.

Reflections

In the Suriname case study relevant geo-information on land use and infrastructure could be collected to generate a base map of the current land use that was considered appropriate for analysing impacts

of new infrastructure. With the Land Use Scanner the effects of the infrastructure plans were modelled based on an operational scenario. The local suitability of land units were modelled with multiple maps on the current land use, physical properties, planning policies and distance relations. We experimented as well with different rules in the model, attaching different weights to the suitability factors. One scenario was established in a stakeholder training session, resulting in a higher quality of the model results, and, more importantly, contributing to a higher awareness of suitability factors that may influence land use in the future.

All information – ranging from animations of changes in land use, to maps, data and software – has been made accessible to all on the internet. Additional research may expand our understanding of the impact of new physical infrastructure by investigating impacts in neighbouring countries, since impacts of newly planned infrastructure do not end at the border. Moreover, the impact areas could be analysed in more detail by including regional demands at the district level. Plans and accompanying assumptions at the district level of Suriname could be incorporated into the model, leading to a more comprehensive investigation of impacts on the spatial environment. Finally, as soon as information becomes available on the exact location or trajectory of new physical infrastructure, the model should re-run automatically all procedures including this new information.

The method can be applied at a smaller scale as well, for instance to assess the spatial impacts of infrastructural plans in the Amazon region. To evaluate the resulting future land use maps, several indicators can be adopted: accessibility, as has been discussed in the fifth section, and also carbon sequestration and biodiversity.

In general, these data, tools and scenarios enable the construction of meaningful images of future impacts of road construction on the use of land and resources.

Stakeholder participation plays a vital role in the preparatory process of defining the relevant parameters for the model. Results of modelling may subsequently be used to discuss desired and non-desired outcomes with a larger group of stakeholders. Counteracting measures may be discussed with stakeholders, and new rules can be fed into the land use model to calculate whether these improved countermeasures sort the desired effect on future land use. In this way land use models can support the optimisation of routing of new road and the development of participatory policies regarding infrastructural proposals and plans.

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5.

TROUBLESOME ASSESSMENT: CONTROVERSIES OVER THE MANAUS-PORTO VELHO HUB AND ITS IMPACT ASSESSMENT

MARINELLA WALLIS

Introduction

The construction and pavement of highways in Amazonia have raised fierce debate over the last three decades. Among the most contested road construction projects in Amazonia is the proposed pavement of the BR-319 connecting Manaus with Porto Velho. The controversy over the pavement of the road itself as well as the assessment of its potential socio-economic and environmental impacts is related to the significant environmental consequences of the road as it may contribute to the opening of the western part of Brazilian Amazonia which so far has been among the least accessible and affected parts of Amazonia. At the same time, the road may play a key role in connecting the industrial hubs of Manaus and São Paulo. In order to get a license for building the road, the Ministry of Transport had to undertake a strategic environmental assessment (SEA) as required by IBAMA, the federal environmental agency.

The assessment study that was subsequently undertaken was comprehensive and developed by a large multidisciplinary team of researchers. However, the complications related to this SEA have continued for a long period starting 2005 until the time of writing this chapter. By now (May 2014), the license has not been issued and the procedure not yet finished. The controversy was clearly reflected by two contradictory presidential messages. Initially, in 2008 Presi-

dent Lula, during his visit to Manaus, announced that the road was to be built in due course. Subsequently, President Dilma Rousseff announced during her visit to Manaus in 2011 that the construction of the road was cancelled. These messages reflect the conflicting character of the plans and policies of the different government agencies involved, which eventually led to a stand-still in the licensing procedure.

The study is organized as follows. The following section focuses on the background and context of the plan to improve and pave the BR-319 in order to clarify the conflictive character of the project and the assessment study. The third section focuses on the policy context of the environmental impact assessment itself, and in particular its plan of action. Section four deals with some major points of criticism on the assessment study that played a key role in the debate on the assessment and its implications. The final section presents some concluding observations.

Background and context of the BR-319

Federal policy towards the northern region

The BR-319 was built in the 1970s during the era of the military regime as part of a larger plan to open Amazonia and connect the region with the rest of Brazil. Main objectives of the strategy were improvement of accessibility of the region, and support for the development of agriculture, cattle breeding, forestry, timber logging, and more generally the exploitation of natural resources. The policy of occupation started with the Plano de Integração Nacional (PIN 1970) and was followed by other land-use policy incentives (Rodrigues-Filho et al. 2012). Priorities were reflected by the well-known slogans of the time: *integrar para não entregar* – integrate the Amazon into Brazil to save it from falling into foreign hands – and *uma terra sem homens para homens sem terra* – a land without people for people without land. The policy clearly was not aimed at supporting the indigenous population. These policies resulted in a shift in the composition of the regional population with an increasing number of agricultural smallholders with a clear interest in road infrastructure to facilitate access to markets.

For over 30 years, the northern region has served for the federal government as an area to be colonized for security, economic and social reasons. Developmentalist policies pursued by successive governments involved the construction of a series of major roads to link the area with population centres in the northeast and south. Along the roads colonies were established to settle migrants. In support, generous tax and credit incentives were provided to attract settlers and investment. The resulting land-use patterns were erratic and incompatible with sustainable development. Starting in the late

1980s, Brazilian governments along with donors and NGOs proposed territorial planning in support of a more orderly type of land use in the Amazon region (Mahar 2000).

The initial road-building of the BR-319 in the 1970s was executed without consideration of economic viability or environmental impacts and even a thorough estimation of expected traffic intensity was not made (Fearnside and Graça 2006). The road was built hasty, its use was limited, maintenance was poor and so was its condition. Limited use of the road was due to difficult terrain and relative high transportation costs as compared to river transport. In 1988, the bus line from Manaus to Porto Velho was suspended for security reasons and passing the road was forbidden. Rumours have it that local barge owners ruined the road on purpose as they feared substantial loss of income due to competition by road transport.

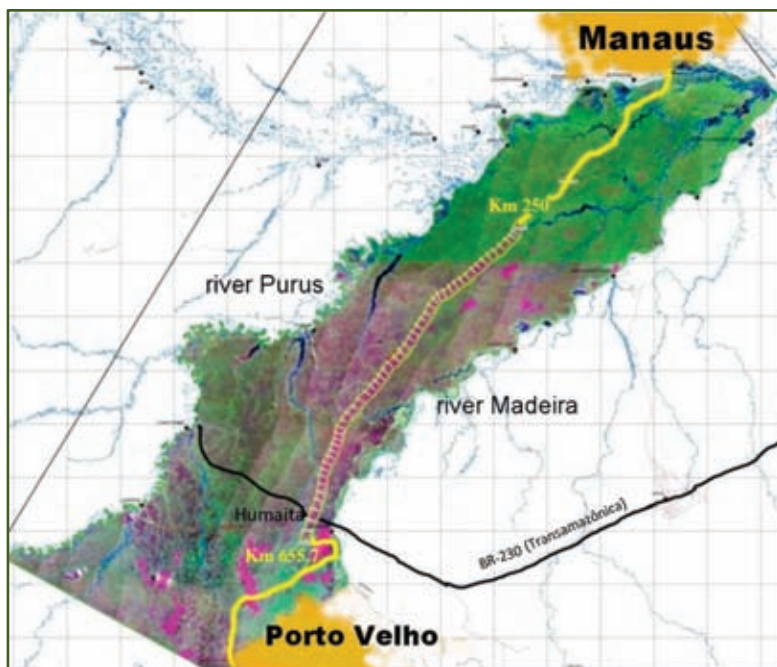
Logistics at the regional level

The only way to transport goods between Manaus and the south-eastern part of the country (São Paulo and Rio de Janeiro) so far is by air or water. The growth of Manaus and its industrial heart, the Polo Industrial de Manaus, stimulates local interest in the restoration of the road to Porto Velho. Eventually in the first tranche of the Programa de Aceleração do Crescimento (PAC) nearly 700 million reais (about 262.5 million US dollars in 2005) were budgeted; according to plan the road would be ready by 2011. No economic feasibility study was made notwithstanding the substantial investment involved (Fleck 2009).

Since the 1980s Brazilian law requires an EIA-RIMA (an environmental impact assessment and its report) to assess socio-environmental impacts of the building of infrastructure. However, this requirement was disputed in the case of the BR-319 as these infrastructure works were considered to be a restoration of an already existing road rather than construction of a new road. This point of view was opposed by the argument that the significance of the biodiversity in the area adjacent to the road, which had hardly been used over a long period, required an impact assessment.

The BR-319 is a road of almost 900 km but the required EIA, to be executed under the supervision of IBAMA, covers just over 400 km: from Manaus at km 250 until km 656. The reason for this spatial limitation is that the stretch of road situated more or less in the middle of the trajectory must be regarded as new, as no traffic had passed for a long period of time due to the poor condition of that stretch of road, as compared to all the rest of the road which was in a better condition and in use. Map 5.1 shows the road and its impact area between the River Purus and the River Madeira, both tributaries to the Amazon River.

Map 5.1 The BR-319 and adjacent territory between the rivers Purus and Madeira



Source: Adapted from UFAM 2009b.

Moreover, the impact area is of significance for the livelihood of indigenous peoples. Road improvement may facilitate migration into the area and add to the risks involved in the opening of the territory.

Broader pressures in support of the BR-319 connection

Manaus plays a central role in the development of infrastructure in the north of Brazil. In the lay-out of IIRSA Manaus is a pole in the Amazon Hub, which connects the Pacific and Atlantic Oceans as shown in Map 5.2. Moreover, the BR-174 which is part of the IIRSA Guyana Shield Hub connects Manaus with Venezuela and with the Guyanas and the ports at the Caribbean Sea.

Substantial intra-regional trade flows have developed between Manaus and Porto Velho, which is to a large extent a transit connection with the industrial centre of São Paulo. Goods are transported by road between São Paulo and Porto Velho and by ship between Porto Velho and Manaus. A road connection between the two cities would facilitate trade significantly. Moreover, such a road connection for its part may link up with the IIRSA Peru-Brazil-Bolivia Hub, thus creating a connection with the Pacific Ocean. The infrastructure

Map 5.2 IIRSA hubs in the north of South America

Source: Adapted from www.IIRSA.org.

programme PAC includes more plans to enhance the connectivity in the northern region and the exploitation of economic opportunities due to a convenient location from the perspective of global trade, abundant availability of hydroelectricity and natural resources. These developments and potentials contribute to the pressure for a road connection between Manaus and Porto Velho.

In addition to these broader regional developments, the Ministry of Transport developed plans for a local road network in connection with the BR-319. As put by the National Department of Transport Infrastructure of the Ministry of Transport (DNIT): the reconstruction of the BR-319 in combination with the conservation of the stretches that are already in good shape will be fundamental to create a hub of integration and end the isolation of important settlements in the state of Amazonas (UFAM 2009b). However, such a road will increase migration into the area (Fearnside and Graça 2006 and 2009).

Crucial for the potential impact of the BR-319 are the plans to construct a series of roads to connect the municipal settlements along the rivers Madeira and Purus with the highway. One of these roads is planned to cross the Purus River at Tapuã and continue in western direction towards Tefé and Juruá. Such connections support small farmers in the settlements along the road but open as well large forested areas in the western part of the state of Amazonas. It should be noted that migration into these areas is facilitated as well by the Transamazônica (BR-230) which was built in the early 1970s with the explicit purpose to stimulate migration into the area. As shown in Maps 5.1 and 5.3 the intersection of the two roads is at Humaitá, 220 km north of Porto Velho.

The risks of significant and large-scale deforestation and change in land use may be assessed more accurately when the construction

of the BR-319 is put in a regional perspective. There is an accumulative effect of the main drivers of deforestation in the region, which are: the building of the BR-319 and its vicinal roads; the BR-317 in the western Amazon state of Acre, which was licenced recently; and the BR-364 – also known as the Pacific Road – that links Cuiabá in the state of Mato Grosso with Rondônia and via Porto Velho with the state of Acre and Peru. See Map 5.3.

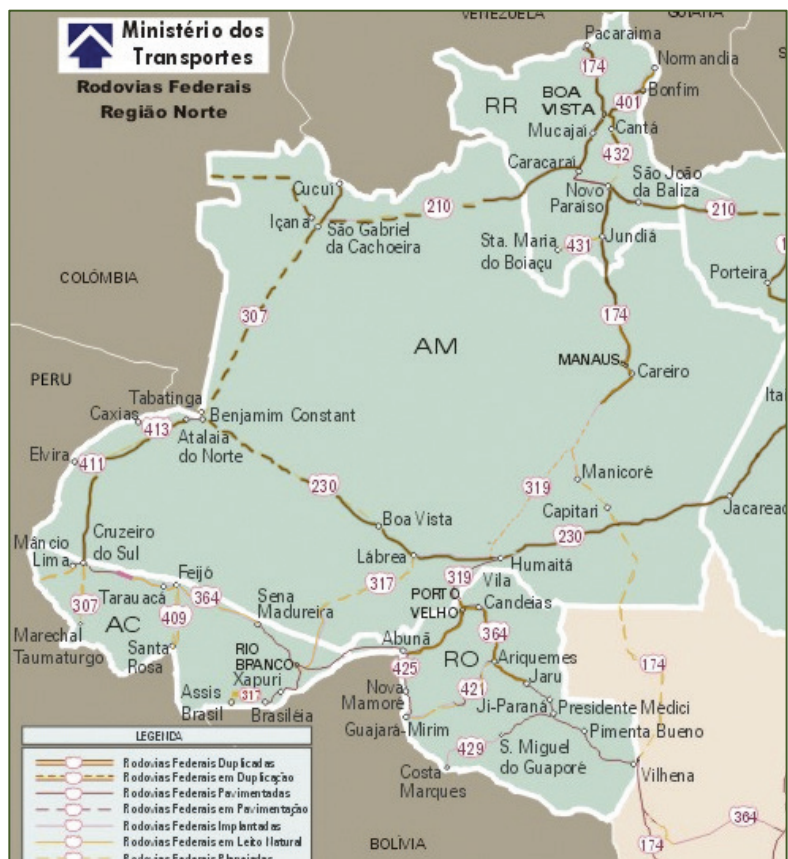
Context of the EIA/RIMA

After the federal government announced the reconstruction of the BR-319, arguments started and by mid-2005 a judicial decision by the Ministry for the Environment imposed a ban on all reconstruction works on the BR-319. Moreover, the decision required the DNIT to present an EIA/RIMA to IBAMA in order to obtain a license. In addition, a Federal Decree in early 2006 issued an Area under Provisional Administrative Limitation (ALAP) to create a more explicit legal regulation of the area and to facilitate surveys to be carried out in order to create conservation units along the road. The ALAP covered the interfluvial area between the Purus and Madeira rivers and prohibited construction works within the area. Map 5.4 shows conservation units already in existence and units to be created, either as fully protected areas or as areas permitting only sustainable activities. The map shows the important role destined to these conservation units in order to contain the impacts of road construction.

The DNIT commissioned the EIA/RIMA in 2007. The study was made by a team most of which were researchers at the Federal University of Amazonas (UFAM). A group of 57 researchers from a wide range of academic disciplines was contracted. The process was supervised by IBAMA. The available budget amounted to 1.5 million US dollar. (Van Dijck 2013). The final results of the study were planned to be issued in 2009. At the time that the EIA/RIMA was initiated, Alfredo Nascimento was Minister of Transport. Later on, in March 2010, Nascimento would be running for governor of the state of Amazonas with the rebuilding of the BR-319 as one of his selling points.

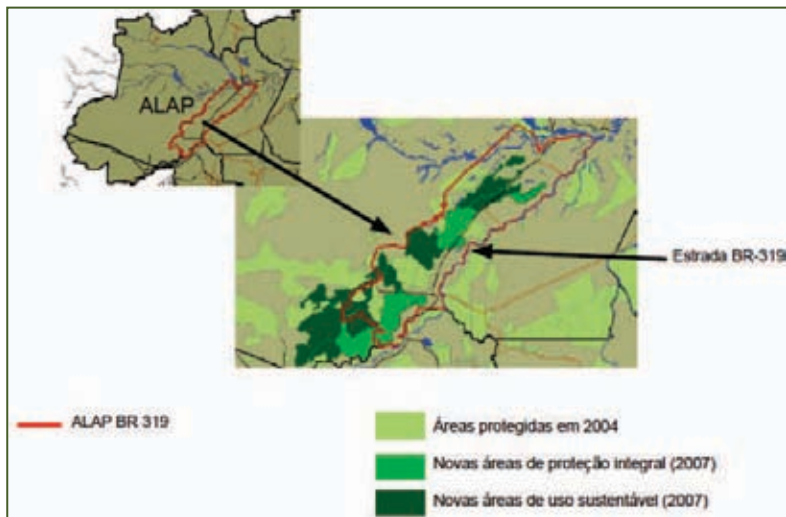
In September 2008, after Minister of Transport Nascimento had published that the environmental licence would be ready and issued, President Lula announced the reconstruction of the road during his visit to Manaus in October 2008. Thereupon, the Minister for the Environment, Carlos Minc, passed a provision that constituted a 60-days period of suspension of the licencing procedure and created the

Map 5.3 Federal roads (paved, unpaved, and planned) in northern Brazil



Source: Adapted from Ministry of Transport, http://www.mapa-brasil.com/Mapa_Rodoviario_Regiao_Norte_Brasil.htm.

Working Group BR-319 to oversee the EIA/RIMA process. As formulated, the main objective was ‘to define, plan and present preventive measures to be taken in relation to the impacts of the road construction, in order to halt deforestation and de-characterization of the Amazonian biomass along the road’ (Parecer Técnico 2009). The Minister of the Environment ordered as well the assessment and quantification of the costs of implementing and maintaining the ten planned conservation units along the BR-319 (IDESAM et al. 2009). The intention of the Ministry of the Environment to demand a budgeting plan to implement them shows the recognition of conservation units as a strong governance instrument.

Map 5.4 Area under Provisional Administrative Limitation (ALAP)

Source: Grupo Permanente e Trabalho Interministerial sobre Desmatamento na Amazônia (http://www.casacivil.gov.br/camaras/grupos/amaz_legal).

Conservation units

Conservation units are part of the National System of Conservation Units (SNUC). The Department for Sustainable Development of the state of Amazonas opted for the creation of such units along the BR-319. The department considered conservation units effective instruments to create a *barreira verde*, a 'green wall' to impede negative impacts of a road. These conservation units help safeguarding the integrity of ecosystems and their environmental services, such as soil conservation and watershed protection, nutrient recycling, and climate regulation. Moreover, they protect the habitat and culture of the indigenous peoples living in these areas (Veríssimo et al. 2010). The most important aspect of the SNUC, which is embedded in the Código Florestal (Forest Law), is the legal support it provides for conservation governance.

However, the SNUC is far from a consolidated system and a number of major implementation and governance challenges still have to be addressed. Designation of an area as protected and demarcation of its boundaries is a complicated process as land titles may be unclear. In the case of public land three different tiers of government – at the federal, state or municipal level – may be the owner, all having their own policy objectives. Moreover, different priorities concerning the specific nature of protection itself – ranging from fully protected areas towards areas for sustainable use – may be an additional complicating factor.

Note that until recently most protected areas were located outside the potential impact areas of economic activities and hence required limited protection only. At present however, 84 per cent of protected areas are situated within the potential impact area of economic activities and face increasing pressure due to the construction of infrastructure – e.g., roads, electrical grid – and the expansion of agriculture lands (Barreto and Childress 2010).

Questioning legality

Notwithstanding the issuing of the ALAP a construction company contracted by DNIT started works half a year later. These construction works were claimed to be in accordance with the directives of the National Programme on Environmental Regularization of Federal Paved Roads. According to this view, the works did not involve construction of a road but its restoration, for which no EIA/RIMA was required. However, after inspection IBAMA concluded that the works involved road pavement and therefore were illegal. This position was upheld by the Counsel for the Prosecution of the State of Amazonas (Parecer Técnico 2009). These legal conflicts did not bode well for an EIA/RIMA to be undertaken, as became apparent during the conflict over the terms of reference. As put by Rivas, the coordinator of the assessment study: ‘The impossibility to deliver a final version of the terms of reference in time was an obstacle for the assessment team to produce the study in the appropriate way, and required significant adjustments and several revisions at late stages’ (Van Dijck 2013, Chapters 9 and 10).

In this conflictive context Operation Razor-blade is noteworthy. In July 2007 the Federal Police put the BR-319 project ‘under suspicion’ while dismantling a corruption scheme of 100 million reais, which involved the construction company and over 225 persons, including ministers, senators, parliamentarians and staff members. Minister Nascimento and the Governor of the State of Amazonas were among those involved (IDESAM et al. 2009).

Critical reception of the EIA/RIMA

The EIA has been criticized from several angles including IBAMA, INPA and NGOs like IDESAM and others. IBAMA considered the EIA/RIMA insufficient as a basis for providing a licence and consequently the project came to a halt. According to IBAMA, the report suffered from flaws in the analysis of physical and biotic aspects, and from serious shortcomings in the socio-economic analysis. Moreover, it fell short in making an adequate assessment of potential impacts of road construction and the formulation of proposals to mitigate such

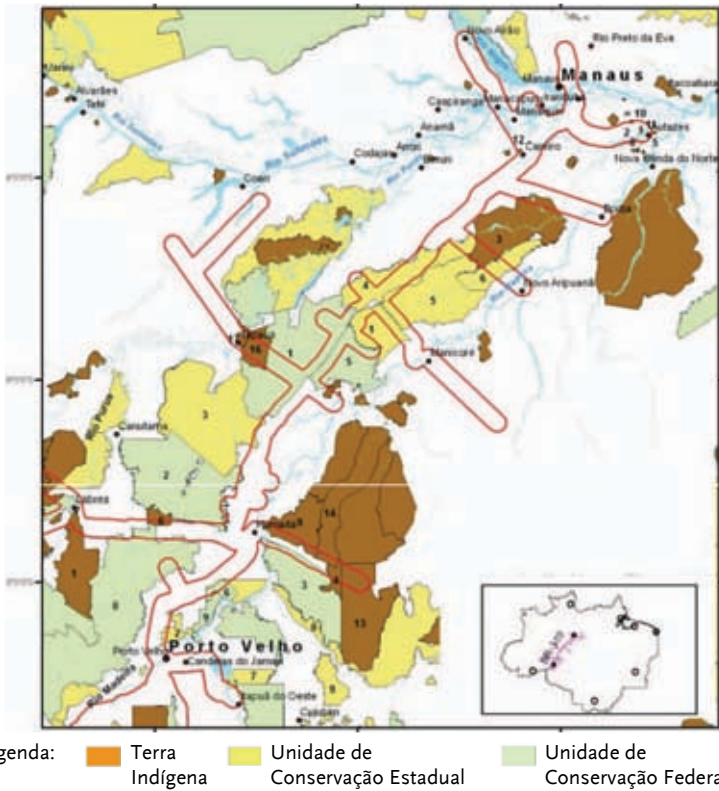
impacts. IBAMA criticized the recommendations for being excessively dependent on the role of protected areas and indigenous lands in mitigating negative impacts, which was rather premature in view of its lack of manpower and financial resources to manage such areas. The majority of the 61 indigenous lands – more than a third of which still had to be legally acknowledged – is under threat and subject of conflict. More worrying is the situation of the four isolated indigenous peoples whose territory yet had to be demarcated.

Delineation of the impact area

The delineation of the impact area was also a point of critique. The size of the potential impact area has major consequences for the organization of the study – including the baseline study and inventories of data – and for the policy implications of its findings. In addition, delineation of the potential impact area has implications for the selection of public institutions to be consulted that have administrative and jurisdictional competence in the area.

Underestimation of the spatial dimensions of the potential impact area may result in underestimation of de facto impacts: the potential positive and negative socio-economic and environmental effects and related values, and hence of required policy measures to mitigate impacts or to compensate for damage or revenues forgone. According to the IDESAM study, the delineation of a 5 km wide impact area on both sides of the road as made in the EIA/RIMA – implying an impact area of 895,387 hectare – is too limited and does not fit the definition of the terms of reference, indicating that: ‘the area of direct impact should constitute areas that are threatened in a real sense or in a potential way by the direct impacts of the implementation of the road, as well of the associated and resulting activities’ (IDESAM et al. 2009). The study states that these boundaries have not been based on technical criteria and that areas adjacent to the road and liable to illegal logging or conversion into cultivated land must be included in the impact study. Moreover, such a narrow zone is not in line with findings of studies on the impacts of roads on land use conversion and deforestation

Map 5.5 shows the spatial impacts of the use of an impact zone of 10 km instead of five km. It shows that quite a few indigenous lands and conservation units located or planned to be located in the interfluvial area between the River Purus and the River Madeira will be affected, and that delineation of a 10 km wide zone on both sides of the road, including vicinal roads, would imply an area comprising 3.6 million hectare instead of nearly 0.9 million hectares. Fearnside and Graça, too, underpinned the significance of including the vicinal

Map 5.5 Impact area of the BR-319 with a 10 km buffer zone

Source: IDESAM 2009.

roads in the impact analysis and criticized the EIA/RIMA for not doing so (Fearnside and Graça 2009).

Impacts beyond the impact area

The impact of a road may extend even beyond the borders of the impact area as emphasized by Fearnside and Graça at the Institute for Research on Amazonia (INPA). Opening of this part of the road will facilitate migration from locations in the Arc of Deforestation, like illegal owners of large areas of public territory, the so-called *grileiros*, and the people participating in the landless movement (Fearnside and Graça 2006). Note that the forests in the state of Amazonas are rather intact and that the state of Rondônia is nearly completely deforested, except for indigenous areas and conservation units. The state of Amazonas, with its forest cover preserved for about 97 per cent, is likely to suffer from deforestation if it will be linked with Rondônia, the northern part of the Arc of Deforestation.

Another point of criticism relates to the expectations concerning traffic flows: 375,000 passengers are expected to travel by bus from 2012 onwards, the date of the expected inauguration of the road, which is remarkably high as compared to the number of inhabitants of the city of Porto Velho, which is about the same.

A major objection of Fearnside and Graça against the EIA/RIMA is the arbitrariness and selectivity in the use of spatial dimensions of probable negative and positive impacts of the road. Assessments of negative impacts are limited to the indirect impact area covering the area between the rivers Purus and Madeira, while benefits are claimed for a much wider area, including the city of Manaus and agricultural areas in Mato Grosso (Fearnside and Graça 2009).

Problematic aspects of assessment

Regional planning

A specifically serious risk in the context of the assessment is that the recommendations and the strategic action plan are strongly linked to region-wide conservation policies that are not fully consolidated and are still the object of political struggle and lobbying. The BR-319 EIA/RIMA is explicitly embedded in the Plan for Sustainable Amazonia – Plano Amazônia Sustentável, PAS – (UFAM 2009a), which is coordinated by the Secretariat of Strategic Affairs. This plan originated from an initiative by the federal government to create regional development plans to diminish interregional economic inequality. Construction of infrastructure is considered a major tool to diminish these inequalities.

The first PAS for the period 2004-2007 was issued in 2003 and many updates were to follow. Becker and Galvão (2010) note that the initial PAS dealt with economic development and environmental concerns in an integrated manner. As put by the Ministry of National Integration (2005), one of the objectives of the PAS is to offer an alternative for the tension between ‘environmentalism’ and ‘developmentalism’. However, the 2008 version of the PAS abandons that strategy and treats environmental concerns as a separate issue. The case of the building of the BR-163 is a striking example. It reduces to a large extent the integrated idea of the PAS 2003 as the road just penetrates Central Amazonia, an area suffering from increasing economic pressures and moving frontiers and – as laid down in the PAS 2003 – requiring a more balanced and integrated policy approach (Becker and Galvão 2010).

Vulnerability of conservation policies

Conservation policies and economic development priorities are continuously in conflict and outcomes are hard to predict. Small and big farmers in the region and their representatives in congress, the so-called *ruralistas*, are continuously framing their rights and lobbying for more land. In June 2012, the Código Florestal (Forest Law) was modified after a lengthy period of protests, manifestations and debates in congress. The voting on the Código Florestal is a clear example of how political forces can change prospects of conservation governance. The most recent alterations of the Forest Law imply total amnesty without restriction for perpetrators of laws that prohibit deforestation; a relaxation of the obligation of forest restoration for past deforesters and a very flexible status of the conservation units.

The functioning of conservation units was further threatened by a proposal for amending the constitution. PEC 215 involves a shift in the competence to demarcate indigenous lands away from the Federal Government to the National Congress. The proposal – target of many protests by indigenous people – would signify that politics and lobbies are able to influence the outcome, making it feasible to change the status of already demarcated areas and hamper the creation of new areas.

Final observations

Impressive results from the EIA/RIMA

Although procedures and policy context prevented the SEA to function as an effective and efficient policy tool so far, it needs to be emphasized that the assessment study itself has been an innovative and comprehensive approach towards understanding potential impacts of a major road on an environment that is of great value from an ecological point of view as well as from the perspective of the livelihood strategy of the indigenous peoples living in the potential impact area. A thorough investigation was made of the living conditions of indigenous peoples in the area. Their representatives were involved in the consultation process in order to analyse their perceptions and priorities concerning the road and measures to mitigate its negative impacts. This investigation resulted in a series of 24 recommendations for policy initiatives. However, in view of the understaffing of institutions involved in the management of conservation units and indigenous lands, the EIA/RIMA observes that cooperation among relevant institutions is required in order to realize strong governance. To make governance work and manage effectively the impact area, even the alternative approach of establishing public-private partnerships is recommended (UFAM 2009a).

Another innovative aspect of the assessment study is the economic valuation of the forest, involving an assessment of the sum total of the indirect use values, option value and existence value. The sum total of the loss of these values was assessed in four scenarios: a scenario with no governance (10.5 billion reais); a scenario with weak governance (5.3 billion reais); a scenario with moderate governance (2.6 billion) and a scenario with strong governance (0.5 billion reais), showing the economic significance of good management and effective protection and governance (UFAM 2009a).

The importance of policy context

The EIA related to the reconstruction of the BR-319 has demonstrated that the policy context of an assessment is of significance for its outcomes and impact. The rationale may be put into question and the terms of reference of the EIA may be a bone of contention between government bodies, as a consequence of which the objectives and terms of reference may lack precision and focus. Moreover, the political context and the relationship between the partners determined to a certain extent the climate of cooperation and the way the study has progressed. As the DNIT-department of the Ministry of Transport commissioned the EIA, the research team seems to have developed the study on the basis of the position that the road was inevitable and that an alternative mode of transportation, such as a railway, was no option. In that context, the proposed option to reconstruct the BR-319 in combination with environmental management and a policy of conservation units to control negative environmental spillovers was reasonable. However, to increase the capability to manage environmental impacts effectively and efficiently, a number of preconditions has to be met in view of the limited capabilities and willpower to implement strong governance in the potential impact area. In that context the question arises whether such critical factors and considerations need also to be included in the assessment study itself.

Not unlikely, the delay in releasing the licence by IBAMA may have been a blessing in disguise. In the course of time, views, preferences, positions and interests may change, and political priorities may shift towards more sustainable options. Moreover, the overall political landscape, and with it the policy context of EIAs and decisions concerning road construction in environmental sensitive areas, may change once more. But the opposite may come true as well. Due to deteriorating economic conditions, or just to growing ambitions, the pressure for economic development in the Amazon may build up.

The licensing process related to the BR-319 shows similarities with procedures related to other roads in South America, as shown in a recent study of the effectiveness of assessment studies of mega-

road projects (Kis Madrid *et al.* 2011). One of the major outcomes of the study is that effectiveness of such studies has been reduced significantly by the lack of capabilities of governments and institutions to implement the recommendations of the strategic action plan, especially when there is a clear lack of capabilities, commitments and institutional arrangements to facilitate actual implementation. For a series of recommendations to enhance the effectiveness of SEAs, see Kis Madrid *et al.* 2011. See also Van Barneveld in Chapter 6 of this Cuaderno.

It may be useful to have a critical look at the policy tool of a SEA itself and assess its function and limitations. The integrated approach for sustainable development as described in the PAS 2003 and proposed by Becker and Galvão (2010) may be considered an interesting alternative for the actual developments as described in this chapter. A SEA or EIA/RIMA may serve as a building block for such an alternative approach but the political arena was apparently not supportive for linking the outcomes of the assessment with the overall policy environment of the country and the institutional setting. As noted by Kis Madrid *et al.* (2011): '[i]n terms of the context of SEA (...), countries need adequate capacities: legal frameworks for conducting SEA; institutional, operative, coordination and monitoring capacities; political will and commitment; and financial resources'. Without a supportive context the impact of even a high-quality SEA will be limited as follows from this study.

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STRATEGIC IMPACT ASSESSMENTS, STAKEHOLDERS' PARTICIPATION AND GOVERNMENT POLICIES

BERT VAN BARNEVELD

Introduction

This chapter studies the contribution of stakeholders' participation to strategic environmental assessments (SEAs) of the impacts of road construction in Amazonia, and the relationship between such SEAs and government policies. Public consultation and participation is a conceptual aspect of SEAs, and more generally an element of good governance. In several Latin American countries public consultation in impact assessments is required by law. The objective of public consultation is to collect information on stakeholders' opinions regarding proposed policies, plans and projects, their possible impacts, sensitive issues, risks and opportunities, tendencies and scenarios. The aim of the consultations is primarily to gather insight into the opinions of stakeholders regarding actions to mitigate negative impacts and to enhance opportunities and other strategic actions that are part of or related to the construction of transport infrastructure. Moreover, the consultation aims at obtaining information on regional institutional capabilities and capacities that are required to implement the strategic action plan.

The chapter is based on the experiences of various SEAs in South America, with particular reference to the SEA of the Corredor Norte, the 1,390 km Bolivian branch of the international transport corridor

Map 6.1 IIRSA Peru-Bolivia-Brazil hub including the Corredor Norte



Source: DHV.

between Southern Peru, Northern Bolivia and South-western Brazil. The corridor is part of the so-called Peru-Brazil-Bolivia IIRSA hub. See Map 6.1. Map 6.2 shows the different types of natural regions in the probable impact area of the Corredor Norte.

At present, most of the Corredor Norte is unpaved and poorly maintained, making transport difficult and even impossible during the rainy season. The project aims at upgrading of the present road into an all-weather road, involving pavement, construction of bridges and drainage works. Initially, alternative routes and alternative transport modes were not considered, but several alternative river transport and bimodal road-river transport modes have been analysed and assessed as part of the SEA.

The reconstruction of the road may have a direct and indirect impact on an area of 230,000 km², equal to 22 per cent of Bolivia's territory. The impact area covers 37 municipalities in three regional governments, which are considered to be principal actors and/or coordinating agencies to implement the strategic action plan resulting from the SEA. The corridor runs from La Paz at 4000 m above sea level over the Altiplano highlands, the steep mountainous sub-tropical Yungas and the tropical forest region of the Andean foot slopes; the latter hosting a wealth of plant species, wildlife, landscapes and ecosystems with one of the highest biodiversity indexes of

Map 6.2 Corredor Norte and natural regions in its impact area

Source: DHV.

the Amazon basin. The central section of the corridor is characterized by sparsely populated tropical wetland savannas and grassy alluvial plains, giving way to the Amazon tropical rainforests in the north, an area with important timber and non-timber forest resources.

According to the 2001 census, the total population of the impact areas of the corridor is 460,000, about half of whom are living in urban centres located along the corridor. The other half of the population are living in widely dispersed small communities. The area is the habitat of 14 different Amazon indigenous groups, several of which are found in the remote parts of the area. About 50 per cent of the total population consider themselves indigenous, either lowland Amazonian or highland Andean; the latter, consisting of eight

different ethnic groups, migrated to the lowlands in several waves since the rubber boom era in the 1880s, a process that is still continuing. The region is also the home of the only ethnic group in Bolivia of African origin. The Amazon indigenous population practises traditional shifting cultivation agriculture, fishing, hunting and forest extractive activities.

The IIRSA Peru-Brazil-Bolivia hub has been planned as an international transport corridor, to improve cross-border linkages between the national road systems, to overcome barriers to regional integration, strengthen markets and promote economic opportunities (IIRSA 2004). For the Bolivian government, the purpose of constructing the Corredor Norte is above all to support the integration of the northern territories with the central part of the country, providing a platform for strategic sustainable development, in which stakeholders, the private sector and indigenous people have increasing responsibilities (DHV 2007a).

The chapter is organized as follows. The next section focuses on the role of public consultations in SEAs and the different approaches of consulting the population in impact areas. The specific approach pursued in the Corredor Norte SEA is highlighted in the third section. The next section deals with the significance of appropriate timing when undertaking a SEA. The role of public consultation in formulating a strategic action plan is dealt with in Section five. The following two sections focus on the characteristics of strategic action plans and the link between such plans and government policies. The final section reflects upon the lessons to be learned from past experiences regarding public participation and government policies and the financial implications of a participatory approach of SEAs.

Stakeholder' participation in impact assessments

Public consultations differ significantly in approach, focus and comprehensiveness. Although public consultation is becoming a standard practice in many SEAs, the constitutional right of indigenous communities and other stakeholders to be consulted about policies and projects that affect them has not (yet) been fully settled and regulated in several countries in the Amazon region.

Public consultations may be undertaken in different ways, ranging from a limited approach of only informing regional, local and village authorities to a more extensive approach of informing and consulting, including also specific stakeholder groups, indigenous peoples, the public and private sector and NGOs. Public consultation may also include the active participation of groups of stakeholders in the planning of alternative routes and alternative transport modes, as well as in the design and implementation of action plans aimed at

the mitigation of impacts and enhancement of opportunities. The selection of an appropriate approach generally depends on the degree and scope of the expected impacts, the existence of conflictive situations, government intentions and the available time and funds for the SEA assessment.

The Corporación Andina de Fomento (CAF) finances major infrastructural projects in Amazonia. The public consultation required as a precondition for CAF finance generally is of a limited approach involving information and limited consultation. Regional and local governments as well as groups of major stakeholders need to be informed about the proposed policy, plan or project and the expected short- and long-term impacts. Actions to reach agreement and consensus with stakeholders is generally not considered to be part of the assessment itself but of follow-up activities to be carried out by responsible government institutions before actual implementation of the project takes place (CAF 2008).

Public consultations in SEAs financed by The World Bank, the Inter-American Development Bank (IDB) and the European Union (EU) are generally more extensive and involve more consultation. These agencies require that opinions and considerations of stakeholders are 'properly recognized'. Governmental authorities and institutions, the private sector and sectoral organizations need to be consulted about the proposed plan or project and the expected short- and long-term impacts. The results of the consultations need to be considered in the final stage of policy or programme planning and design (The World Bank 2002). Consultations with environmental NGOs and organizations of indigenous peoples are considered essential. The consultations may be limited to a representative sample of groups of stakeholders. Small surveys and quick scans may also be part of the consultations.

Important factors that impact on the selection of a particular approach are the availability of time and funds. An approach consisting of only informing regional and local governments can be done in a short period of time, but excluding key stakeholder groups is risky and may be of little use. In contested projects, this approach may even lead to a type of window dressing on the part of the project authority, intended to make the proposed project more attractive. The comprehensive approach with active participation of stakeholders is preferable, but may be time consuming and costly. This is particularly the case in assessments of large impact areas and/or in areas with a large number of (different types of) stakeholders having widely different points of view on the proposed project.

Stakeholders' participation in the Corredor Norte SEA

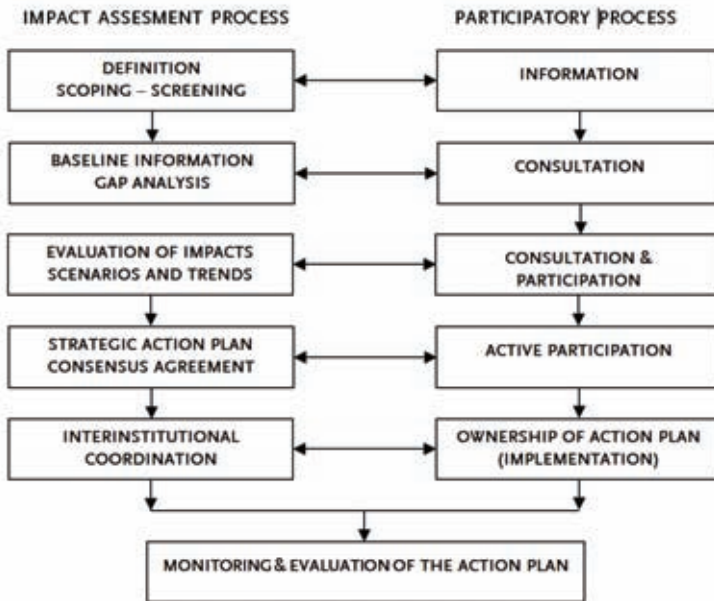
The IIRSA Corredor Norte project has been controversial from the moment of its inception in the late 1990s. Opinions on the reconstruction of the road varied considerably among groups of stakeholders in the region, with many groups in favour but others firmly opposing it, nature conservationists and indigenous peoples in particular. One of the principal objectives of the SEA of the Corredor Norte was to reach agreement on the project with all relevant stakeholder groups in the impact area. This required a lengthy process of meetings, dialogue and active participation, described as a comprehensive approach of stakeholder participation (Van Dijck 2013, Chapter 7).

During workshops with national and regional governments and organizations representing civil society, groups of significant stakeholders in the impact area were screened. The process resulted in the selection of 350 stakeholder groups to be consulted. All together, these groups claim to represent about 90 per cent of the population in the region. Stakeholders were identified according to their potential positions as winners or losers; their potential roles in the decision-making process; and their potentials to provide inputs to the assessment. Subsequently these stakeholders were grouped and for each group a specific consultation approach was planned.

At this early stage, it became clear that the corridor project was more controversial than initially expected. This called for a transparent consultation process, marked by the building of trust and creation of confidence in support of a constructive and open-minded dialogue. The process was planned following a stepwise approach of information, consultation, active participation, as presented schematically in Figure 6.1.

Staff of the consultation teams were selected on the basis of neutrality in the case, their knowledge of stakeholder groups and the socio-economic conditions in the region, and experience with participatory techniques and conflict management. Some team members were required to communicate in indigenous languages. As stakeholders appeared to have difficulty in understanding the scope, degree and geographical dimensions of the expected impacts, audio-visual material was used in the process.

In addition to formal and informal meetings and workshops, working groups were formed of representatives of stakeholder groups and sector organizations, who jointly determined their position on the proposed project and made proposals for actions to mitigate impacts and enhance opportunities. This worked particularly well in the case of environmental and nature conservation organizations, and with the forestry and transport sectors.

Figure 6.1 Stakeholders' participation in the Corredor Norte SEA

Source: Van Barneveld 2009.

Representatives of the organizations of stakeholder groups participated in an introductory round of regional meetings to inform them about the project, objectives of the SEA and their participation in the preparation of a strategic action plan. Participants were asked to air their opinion on the project, their positive and negative expectations and required policies and interventions. Next step was the making of: an analysis of the opinions received; an inventory and analysis of biophysical conditions and the socio-economic and socio-cultural situation; an analysis of possible scenarios and the required strategic actions. Subsequently, these representatives were invited to a second round of consultation. Many of the second round consultations were sector meetings at the local, regional and national level, focusing on the opinions received, on the results of the diagnosis, the scenarios and the required strategies and actions for each scenario. At a third round of consultations a draft strategic action plan was discussed based on the suggestions received in earlier rounds. At a final plenary meeting involving representatives from the entire corridor, the draft action plan was discussed, amended and finally approved.

As follows from the above, the consultation process was a lengthy affair: whereas the terms of reference required 20 consultation meetings to be held, 85 formal consultations and workshops were organized, in addition to numerous informal meetings with individuals

and organizations dealing with specific issues. All together the process required about 15 months. Throughout the process, associations of small farmers, organizations of Amazonian indigenous groups, nature conservation and private sector organizations turned out to be the most involved stakeholders groups. This comprehensive 'consensus approach' resulted in a broadly supported agreement on the corridor project and became a major outcome of the consultative SEA.

The resulting action plan includes actions to mitigate expected negative impacts of the corridor and actions to enhance opportunities created by the corridor construction, including: institutional strengthening and capacity building; design or adaptation of environmental laws and regulations, land ownership and natural resource management. All together, the actions are a framework and a planning guide for long-term sustainable development of the region in relation to the corridor project, based on current ideas on the best options, prepared and agreed upon with stakeholders and their organizations.

Timing and horizons

SEAs are instruments to assist in strategic planning, providing relevant information in early stages of policy, plan and programme development and formal decision making. See European Commission 1994, The World Bank 2002, Dalal-Clayton and Sadler 2004, and MER 2008. Ideally, SEAs are carried out well ahead or during initial stages of formal decision making, as indeed is the case in Europe and countries where long planning cycles are the rule and the instrument of a SEA has been well established. However, in most Latin American countries, SEAs are undertaken after formal decision making has already taken place, which is often due to short planning horizons, not exceeding the terms of a government period, i.e. four to six years. Thus, once a decision on a particular major policy, plan or project has been taken, a SEA need be performed instantly to avoid delaying the project. Proposals for alternative routings or transport modes certainly will imply further delay and consequently are not stimulated. As a consequence, SEAs in the region often are ex-post decisions rather than ex-ante exercises. Some are even not much different from environmental impact assessments (EIAs). Such situations, however, also offer opportunities for SEAs to become pro-active instruments during implementation stages of policies, plans and projects, providing important information for mitigation actions and for the elaboration of project components and related actions to be defined during implementation. A participatory approach might even enhance its impact.

The Corredor Norte SEA is a case in point. The decision to upgrade the road was taken several years before the SEA was undertaken. At that time, the upgrading process had already started, albeit on a fairly small scale. Alternative routes or transport modes were not supposed to be taken into consideration, except for some minor adjustments. On the other hand, the Bolivian Road Authority recognized that the upgrading and reconstruction of the road, with long stretches in difficult terrain and requiring numerous long bridges, embankments, road drainage systems and landslide control works, will take several decades. The Corredor Norte SEA had therefore been planned with the intention to prepare a pro-active instrument to accompany the construction and upgrading process of the corridor over its entire construction period and not just as an instrument to facilitate ex ante project planning and decision making.

In this context it needs to be noted that perceptions and priorities of the population may change in time, as may be the case with national and regional priorities. This limits the relevance of public consultations and related strategic action plans. The composition of the population and the socio-cultural setting in the impact areas may also change in the course of time. The same holds for technological development, and the potentials of regions to develop economically.

For these reasons SEAs and their action plans need to be upgraded periodically particularly when implementation of the policies, plans or projects concerned will take long periods as is the case in many intra-regional road projects in Amazonia. Periodical evaluation and upgrading may allow the involvement of other stakeholders including new arrivals, and it permits considering changing socio-cultural and economic conditions. The experiences also indicate the importance of trend analysis as part of the assessments. GIS and modelling are appropriate tools in the evaluation of trends and, when possible, should be considered in critical stages of the SEA assessment process, depending on the availability of relevant spatial and terrain data (Van Dijck 2013, Chapter 12).

Stakeholders' opinions and strategic action plans

Active stakeholder participation is a critical input for the formulation of participative strategic action plans. Clearly, opinions on impacts and mitigation measures may differ strongly among stakeholders according to their specific interests. Moreover, opinions of stakeholders often are biased by lack of information, and lack of insight into potential impacts. Also, opinions may not properly reflect peoples' own priorities and may be influenced by others. Finally, scope, intensity and geographical spread of the expected impacts are often hardly known ex ante, not even to decision makers and those responsible for

planning and implementation. The devastating effects of the construction of the BR-163 in Rondônia in Western Brazil during the 1980s are a case in point.

In most of Amazonia, the primary concern of many social organizations and indigenous movements in relation to large infrastructural projects such as roads, hydroelectric dams, mining and agro-industrial complexes is the violation of territorial rights. Also 'green capitalism' proposals based on the mercantilization and privatization of natural resources is a source of great concern as this often conflicts with the prevalent traditional Amazonian cultures. About half of the issues mentioned by stakeholders in SEA consultations in Amazonia concern territorial issues. Even in Bolivia, where over the last decades a large number of indigenous territories have been established and demarcated, stakeholders' concerns are still related to conflicts over land use, land tenure and judicial security, as well as legislation that is not or insufficiently based on socio-cultural and socio-economic realities in the region (DHV 2005 a and b). Illegal colonization and the loss of traditional socio-cultural values are also often mentioned.

A second important topic of concern is related to environmental degradation as a result of the construction of roads and other infrastructure. This includes illegal deforestation, poisoning of water resources caused by oil and gas exploration and mining projects, the excessive use of agro-chemicals and the spread of forest fires. It also includes fears of the spread of diseases, environmental impacts due to uncontrolled colonization by people from elsewhere, invasion of natural parks and protected areas, and loss of biodiversity.

Issues related to economic opportunities are generally brought up by the private sector. Comparative advantages and competitiveness of a region may improve with an upgraded road system. This may create new opportunities as well as challenges: the construction of a 600 km trunk road between Santa Cruz and Trinidad in the Bolivian Amazon was intended to assist industry in small Trinidad to market products in the large market of Santa Cruz. However, after completion of the road, Santa Cruz products flooded the Trinidad market nearly destroying the local industry.

In general, the larger the stakeholder population and the longer the proposed road project, the more actions will be proposed. In case of the Corredor Norte consultation, over 120 actions were proposed initially. This 'shopping list' included actions that were only remotely related to the road project itself (DHV 2005 a and b, and 2007 a). Institutional weakness and lack of capabilities make it hard if not impossible to implement all proposed actions simultaneously. Therefore, the universe of proposed actions needs to be converted and reduced into a manageable, viable and consistent strategic action plan. This requires an analysis and multi-criteria evaluation of all

actions proposed with weights attached to the assessment criteria. Several actions may be put together or integrated to enhance consistency and potential impact. Many small actions may present cumulative effects, create synergies or have induced impacts. But other actions may require investments that are not justified under the present economic conditions or are not consistent with present government policies or development priorities. The ranking of the proposed actions in terms of impact, scope and urgency will assist in the preparation of a viable draft action plan. The draft needs to be discussed with stakeholders at a final round of consultations and sector meetings, before it can be presented as a true participative action plan.

Characteristics of a participative strategic action plan

A SEA strategic action plan should be a conceptual framework of actions aimed at the mitigation of negative potential impacts and stimulation of opportunities. As noted in the previous section, many strategic action plans of large scale road construction projects in Amazonia will include actions to protect territorial rights, land tenure and judicial security; land use and territorial planning; enforcement and/or adaptation of environmental legislation and stricter control and monitoring of environmental damages and mitigation. In general, such plans also include initiatives in support of sustainable agriculture, agro-forestry and forestry development, small (agro) industry development, eco-tourism, construction of basic services, and environmental services. Institutional strengthening and capacity building are likely to be prominent actions in almost every SEA action plan.

Experience with the Corredor Norte SEA suggests that a SEA needs to be based on a long-term vision accompanied by a plan for short-term actions to conserve nature, improve the environment and sustain development in the impact areas (Van Barneveld 2008 and 2012). The latter generally implies sustainable use and management of natural resources, potentials and comparative and competitive advantages; the socio-cultural identities and needs of the stakeholders and the presence of competent and efficient institutions. Actions that need longer periods to be implemented can best be designed and organized in phases. The actions may be grouped in programmes as their combined and cumulative effect is potentially larger than the sum total of the effects of individual actions.

It also follows from experience that SEA action plans need to be viable and coherent, to be implemented over a limited period, preferably not exceeding the government planning cycle. At the end of each period, the results need to be evaluated and a next phase action plan has to be drafted for a new planning cycle to reflect the progress

made in implementing the policy, plan or project, as well as changes in the socio-economic conditions and the political context that may have occurred. The action plans need to be capable of responding to external changes, in order to identify, formulate and implement new strategic actions that may be required. SEA action plans ideally should offer a multi-sector strategy of integrated actions that are consistent with government policies and development objectives. Some actions will refer to activities and projects that are already implemented in the region or in process of implementation, but which need to be strengthened, extended in time or expanded in scope or geographical coverage.

SEA action plans need to be realistic, based on the capabilities and capacities of the institutions that coordinate the actions. Preferably, these institutions operate at the highest possible level of coordination in the relevant region. At the same time, ownership is crucial and actions should be implemented at the lowest level of ownership according to the principle of subsidiarity. The plans need to be flexible, permitting stakeholders and implementing institutions to design and implement the actions according to their vision, ideas, objectives and institutional capabilities and capacities. Finally, strategic action plans need to have a monitoring and evaluation component with adequate guidelines for the use of indicators and for monitoring and evaluation responsibilities.

Strategic action plans and government policies

SEA action plans need to be consistent with policies and plans of national, regional and local governments, non-governmental organizations and the private sector. In this context, limited institutional capabilities in many parts of the Amazon region hamper effective implementation of policies and plans. Moreover, at the level of central governments, lack of knowledge of resources and potentials of Amazonia is noticeable, although the situation is gradually improving (Van Barneveld 2012). Many government policies are designed for very different situations outside the region, may be out of scope and context and not applicable. Many consider the Amazon region to be ‘a last frontier’ of development, an unknown Eldorado with an enormous richness in resources, ready to be exploited (Commission on Development and Environment for Amazonia 1992). For these reasons it should not come as a surprise that government policies are often incipient and out of scope, not reflecting the realities of the region. For some sectors, government policies are even lacking and in urgent need to be developed. Considering the lack of appropriate policies in many parts of Amazonia, a SEA should preferably also support overall policies by providing knowledge, insight and advice,

and by being instrumental for the implementation of sustainable development policies, in line with the needs of the government planning institutions.

The development and implementation of land use policies and spatial planning may benefit from SEAs and SEA principles and from the integration of both types of policy-focused studies. See Partidario 2004 and Elling 2000. SEAs and spatial planning have several characteristics in common: both are instruments to support decision-making; they are pro-active by nature and address indirect, cumulative and multiplier effects beyond the limits of an individual project. SEA principles applied to spatial planning appears to be particular useful in large areas and in four major sectors: rural land use and agricultural development; location and development of urban centres with their regional socio-economic functions; location and development of primary and secondary regional transport networks and the planning of the ecological structure of these areas (DHV 2007 a and b).

Final reflections

In Amazonia SEAs have become a standard tool for development planning, policy and decision-making, and for management of environmental and social-economic risks in specific projects, plans and programmes. SEAs are systematically integrated in the lending portfolios of multilateral and national institutions. In many Latin American countries, SEA assessments are nowadays required by law. Promising SEA experiences are emerging, but procedures vary widely and many suffer from serious shortcomings (Van Dijck 2013, Chapters 4 and 12).

SEA procedures and methodologies have been designed as a relatively open-ended consultative and interactive process. There are no clearly defined and strict SEA procedures and within a general framework, each particular case requires a specific approach. However, two aspects are crucial for a SEA to be effective and meaningful: effective partnership with stakeholders by means of public participation and a society open to policy debate, particularly on sustainable development.

Reflections on the concepts, scope and methodologies of SEAs

Additional methodological development is required for SEAs to proactively assist in strategic decisions and the design and implementation of risk management projects resulting from climate change such as severe drought, inundations, forest fires and other risks related to El Niño/La Niña phenomena. Monitoring and evaluation guidelines

for SEA assessments also need to be developed and incorporated, including institutional strengthening and capacity development. In line with above reflections, SEAs nearly always should be regularly updated as conditions change and policy making moves forward. Updating is particularly required in case of large mega-projects and programmes which take many years or even decades to be completed.

Reflections on public participation

As shown in previous sections, the Corredor Norte SEA has involved a comprehensive and participatory approach of consultation, assessing impacts and designing a plan of action, in relation with a highly contested road project that potentially impacts significantly on a vast stretch of land. A participatory approach was considered necessary to create space for a dialogue with civil society aiming at a broad consensus on the project. This approach was time consuming and costly. In spite of its shortcomings, the effort has resulted in consensus and so far no major conflicts over the road have emerged. However, it may be questioned whether alternative approaches may have been more time and costs efficient in generating similar results and a comparable degree of consensus. A rapid rural appraisal or an approach based on a limited sample of representative stakeholders, supported by the collection and use of secondary information are cases in point. There are arguments in favour of the position that in a situation of well-organized, powerful and vociferous social organizations, such alternative approaches probably would not have resulted in a comparable level of consensus. In such circumstances follow-up actions, aimed at stakeholder groups that continued resistance against the project, might probably have been necessary. The lesson learned from this and other cases is that a consultative process with transparent and unbiased dialogue and exchange among stakeholders is a crucial requirement for a successful SEA, particularly in a highly conflictive context. Lack of appropriate consultation may entail the risk of continuous conflicts that are hard to solve at a later stage. Particularly in conflictive cases as roads often are, well planned and conducted public consultations may be a powerful instrument with benefits that outweigh costs, both financially and politically.

Reflections on the costs of SEAs

SEAs are sometimes seen as yet another potentially time and costs demanding exercise, delaying and even obstructing projects. However, it should be noted that the return on the investment required for a well-planned and implemented assessment can be high. Several studies conclude that benefits of SEAs tend to exceed costs substantially (The World Bank 2002). Costs may be cut by operating with a small core team of a regional planner, environmentalist, economist

and social scientist, supported by experts contracted for only a short period of time and for specifically defined assignments.

Although the potentials of a SEA to improve welfare are considerable, its impacts depend on the quality of the study and the effectiveness and efficiency of implementation of the strategic action plan. Moreover, spill-over effects may occur. In the case of the Corredor Norte SEA, the study generated a database on natural resources and socio-economic conditions in the impact area based on available information, supported by only limited additional research efforts, site visits and consultations with local people and experts in environmental hotspots. The database provides information for sustainable development policies and projects.

SEAs may play a significant role in the integration of environmental and social objectives in planning processes by improving links between environmental, social and economic factors. SEAs may generate significant benefits by supplementing and in many cases reducing the necessary scope and costs of EIA downstream. SEA principles can also be incorporated in regional planning and land use planning as has been done elsewhere in the region, limiting the need for separate or additional environmental impact assessments (Van Barneveld 2009 and 2012).

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7.

SEAS AND THE CHALLENGE OF SUSTAINABLE DEVELOPMENT: IMPROVING EFFECTIVENESS AND STRENGTHENING THE INTERNATIONAL LINKAGE: CONCLUSION

PITOU VAN DIJCK

Introduction

The chapters of this Cuaderno have shown that the anthropogenic pressure in Amazonia has strongly increased due to a wide range of large-scale economic interventions including investment in mining, agriculture, hydro-energy and road construction, the inflow of workers and of migrants. Right up front, however, it should be noted that the diversity among municipalities, provinces and regions within Amazonia is significant in terms of level of economic development and speed of transformation, overall development strategy, anthropogenic pressure and degree of environmental degradation, as shown by Buitelaar in Chapter 2 of this Cuaderno.

More specifically, road construction plays a key role in the opening of Amazonia and the socio-economic and environmental transformation of the region. Note that the spatial impact of roads, as measured by the extent of their impact areas, varies strongly among locations depending on a range of variables. However, in general, land use conversion and deforestation are strongly concentrated in vast areas along road trajectories.

At the same time, the increasing economic significance of timber and non-timber forest products, and of environmental services, which may result in payment systems and markets for environmental goods and services, will make it paramount to assess more comprehensively the values of these products and services in the context of local and regional development planning as well as in the context of SEAs. Effective and efficient plans of action and policy frameworks are required to make roads contribute to socio-economic progress and reduce their negative environmental impacts. According to the rules and regulations related to large-scale road programmes like Brazil's growth acceleration programme PAC I and II, and the region-wide IIRSA/COSIPLAN, *ex ante* investigations are required into the potential socio-economic and environmental impacts of roads, and a related strategic plan of action needs to be formulated in order to enhance socio-economic impacts and limit negative environmental impacts. The aim of such investigations is to enhance welfare effects of roads and limit environmental costs. However, notwithstanding the sincere efforts of individuals and institutions involved in the making of such studies, the ambition to stimulate sustainable development by linking finance for infrastructure with thorough environmental assessments has been put under pressure by governments requiring such assessments to be made in a relatively short period of time and with a small budget. Also, financial institutions involved in infrastructure programmes and projects may compete not only with financial terms of loans but also by softening the conditionality of the loans. Moreover, political objectives and ambitions at the national, provincial and local levels may strongly influence the role a SEA may play in the decision-making process and the probability of the execution of the recommendations as laid down in the plan of action.

The study by Kis Madrid et al. (2011) of the effectiveness of four SEAs related to mega-road projects in South America shows that in many respects SEAs fail to realize their ambitions. The study addresses timing; regional or sectoral management planning as a contextual factor; and implementation of the management plan. The study finds that none of the four SEAs were undertaken before the project was chosen. Also it was found that none of the four SEAs studies compare possible alternatives to the proposal; that only one of the four SEAs includes appropriate public consultation and involves local or indigenous communities adequately; only in one case it could be concluded that the country has operational budgets for the implementation of the action plan; and that none of the countries had the institutional capability to implement the action plan; finally, the study finds that actual implementation of the action plans as well as monitoring mechanisms suffer from many shortcomings (Kis Madrid, Hickey and Bouchard 2011). Findings presented in this

Cuaderno by Wallis in Chapter 5 and by Van Barneveld in Chapter 6 support these points.

Clearly, SEAs have great potentials to contribute to sustainable socio-economic development and limit environmental destruction, but if the assessment studies suffer from serious analytical flaws and weaknesses, action plans lack coherence with policy context, and/or institutions supposed to implement strategic action plans lack effectiveness and efficiency, welfare effects will be forgone and ecosystems and biodiversity will be harmed excessively.

This chapter focuses specifically on some dimensions of a SEA deemed to be critical to enhance welfare impacts and mitigate negative environmental impacts of infrastructure programmes. Specifically the chapter focuses on: (1) the significance of appropriate timing of impact assessments; (2) the potential contribution of modelling in support of impact assessment; (3) the potential advantages of a participatory approach of such an assessment study and the formulation of a plan of action. These aspects have been dealt with in previous chapters and are further elaborated and integrated here by way of conclusion and as a reflection upon the potential contributions of SEAs to policies for sustainable development in Amazonia. Finally this chapter will deal with a dimension of SEAs that has hardly been studied or even touched upon in much of the literature on assessment studies: (4) an integration of SEAs in policies at the appropriate policy level and the creation of an effective linkage between SEAs and EIAs and international treaties. The sections below build upon earlier chapters of this Cuaderno as well as Van Dijk (2013).

Timing and routing

Appropriate timing is critical for the SEA to have optimal impact on welfare and sustainable development in the potential impact area. Baseline studies and surveys may facilitate optimal planning of roads. An early involvement of stakeholders may contribute to the development of alternative routings and to a decision-support system that can design an optimal routing based on economic, social, environmental as well as technical and transport-related considerations. Not only may such an approach contribute to superior routing as compared to routing proposals made unically by government agencies with a limited number of stakeholders, but it may well result in higher levels of satisfaction and more cooperation with local stakeholders in the impact area.

Mega-infrastructure projects are usually considered to be of national interest and are initiated by national governments, possibly in cooperation with governments of neighbouring countries in case of international corridors, as well as financial institutions, domestic or

foreign private firms. In the early stages of the project, government institutions and some selected sector-related stakeholders – such as the sectors of transport, mining, energy, industry or real-estate, with direct interests in the proposed operation – are involved in the design of the corridor.

Adequate preparation of optimal routing may require involvement of other stakeholders at the regional or local levels including the local populations along the expected trajectory. The preferences and knowledge of these stakeholders may contribute to the selection of a routing which would be optimal from their welfare perspective. The decision-making process concerning the lay-out of the corridor may be facilitated by the depiction of relevant alternative routings in GIS-driven maps, presenting spatially the information pertinent to the lay-out of the corridor including key performance characteristics with respect to the economic, social, environmental, technical and commercial dimensions. Such an approach enhances transparency of the decision-making process.

As shown by Keshkamat (2011) multi-criteria analysis allows different stakeholders with different perspectives and concerns, to arrive at a consensus, or at a set of consensuses. Spatial multi-criteria analysis delivers the spatial equivalent of such consensus: a map of the area through which the road potentially traverses, in which the suitability of each pixel for the passage of the road is calculated, based on criteria put forward by the involved stakeholders, along with the weight or preference they attach to each criteria (Malczewski 1996). Once such a suitability map is derived, GIS techniques such as least-costs path or network analysis can be applied to identify the path of least resistance between the chosen locations of origins and destinations. The so-called path of least resistance represents a routing for which net negative impacts (costs) have been minimized and/or net positive impacts (benefits) have been maximized. It is thus an optimal route from the perspective of a particular consensus. In a similar way optimal routes can be derived for other relevant perspectives. Commonly used perspectives are equal vision, most environmentally friendly vision, economy vision, social vision, and least construction costs vision. The optimal routes derived for each of these visions may incorporate a vast range of criteria of an environmental, social, economic, technological and techno-commercial nature, identified and weighted by the stakeholders and experts involved in the public participation process. This technique can also make direct use of remote sensing imagery in route planning, a technique particularly useful and costs-efficient in environments or potential impact areas characterized by densely forested, mountainous, or riverine territories, which are cumbersome for collection of data (Keshkamat 2011).

Routings developed by such techniques not only make better use of local knowledge of the socio-economic and environmental situa-

tion, which can potentially improve the overall feasibility of the project, but also enjoy higher stakeholder satisfaction, and therefore reduce possibilities of delays during the actual construction of the project. However this is certainly not a recipe for a win-win situation for all stakeholders: the optimal routings selected by involving stakeholders may substantially differ from the preliminary trajectories selected in the early stages of the project conceptualization by dominant economic partners identified above. As indicated by Van Barneveld and Wallis in previous chapters, the benefits of public participation in route planning at an early stage may be significant. Hence, from the perspective of smooth management, appropriate stakeholder engagement techniques, which can involve the public and/or their representatives, sectoral stakeholders, investors and institutional authorities, need to be established from the outset. See AASHTO and NCHRP 2000, Enserink and Monnikhof 2003, Bailey and Grossardt 2006, Notteboom and Winkelmanns 2007, and Beukes et al. 2011.

It should be noted that even in case of optimal routing – as decided upon at a specific moment of the implementation process of the road construction – relevant group preferences and insights, as well as socio-economic and environmental conditions are likely to change over the course of time during the long-term construction process of the road. This may lead to calls for changing the routing of the corridor or road. The need to change routing may also be required in case of unforeseen events or complications occurring during the implementation process.

Notwithstanding all of the above, it needs to be observed that in many cases the assessment of potential impacts takes place too late in the development process of a road. In such circumstances, the study can adjust the initial plans only to a limited extent and can probably only mitigate, not avoid, serious negative impacts. Hence, because of suboptimal timing, current techniques of highway route planning do not make optimal use of the potential impact assessment in the planning stage of the trajectory. The same holds for suboptimal participation of groupings in this process as discussed later in this chapter.

Mapping and modelling impact areas

Standard practice in SEAs is to determine *ex ante* – as part of the terms of reference – the potential impact area. In most cases wide rivers, mountain ranges and national borders are considered as borders of the potential impact areas and delineate the territory to be analysed. In the case of the BR-319 between Manaus and Porto Velho (see Chapter 5 by Wallis), the potential impact area is delineated by the River Purus and the River Madeira. In the case of the Corredor

Norte in Bolivia (see Chapter 6 by Van Barneveld) borders of municipalities as well as the country's national borders have been chosen to delineate the potential impact area of the road.

However, there are no logical arguments for such an approach apart from its obvious simplicity. To start with, the size of the potential impact area – as measured by distance from the road – differs among locations along the trajectory of a road depending on a large number of variables related to climatic circumstances, land suitability including the quality of the soils, distance to infrastructure, markets and service centres, distance to territories already exploited economically and protected areas. Moreover, in the course of time both the type of land use in the impact area as well as the size of the impact area is likely to change. The first point relates to sequential change of land use along the road trajectory. See Andersen et al. (2002 pp 67-68). These changes in land use are probably related to changes in land suitability, (expected) prices of inputs and outputs per unit of land, that is: net present value of the produce, and other variables like technological development, pest control and infrastructure development. Change in the location and spatial extension of the impact area has been explained and shown by Van der Beek, Lassche and Molendijk in Chapter 4. Once the optimal routing has been established we may attempt at measuring the impact of the road in the course of time on the territory that it trespasses. The ClueScanner model presented in Chapter 4 simulates the probable impact area of a road and its impact on optimal alternative land use.

Buitelaar in Chapter 2 focuses on municipalities, regions and provinces that are in a growth and transformation process due to private investment and construction of infrastructure. These local or regional activities may generate transboundary impacts: new local economic opportunities in border areas may be stimulated, but also negative cross-border environmental effects may take place that need to be addressed to avoid loss of welfare and international conflicts. Cases in point are pollution of air, soils and water, illegal hunting and poaching, fishing and gold digging that may be facilitated at both sides of the border by the construction of a road. Two observations are in place in that context. First, the applied methodology of SEAs has not been standardized regionally, which may limit the relevance of SEAs in a bilateral policy context aiming at the creation of bilateral agreements on infrastructure design, location, and required policy measures. Second, the terms of reference of nearly all if not all SEAs in the region do not refer to cross-border impacts although such impacts clearly exist. Remarkably, border areas and cross-border impacts in particular have been neglected in SEAs related to IIRSA and other (international) infrastructure programmes and plans.

Differences between countries in levels of economic development and policies, demographic developments, strategic objectives and

transport and trade interests may influence the development of border areas, and may require policy coordination and cooperation to stimulate sustainable development. Moreover, a fragile and threatened environment may require coordinated management and conservation. Development of border areas in the case of cross-border initiatives is not easy to manage effectively as follows from efforts like Zicosur, the MAP initiative, and PADIF.

To finalize this point, an observation needs to be made concerning impacts beyond the impact area. By definition a SEA-type of analysis as well as the related plan of action, is limited to the impact area of a road and does not take into consideration the integrated impacts of a road system involving several corridors passing through a region. Regional road plans may have impacts at a scale wider than the impact areas of the separate roads: they contribute to fragmentation of ecosystems below their sustainability levels, and may also increase the probability of forest fires.

When assessing impacts the inventory and valuation of the potentially impacted environment and the probability analysis of environmental loss is a complex and contested area. More specifically, the investigation needs to be done with a small budget, within a short period of time, and in an area that in many cases is difficult to access as available infrastructure is very limited if at all. Hence, in vast areas with low population density and limited accessibility, such knowledge about the state and value of the environment is often limited and costly to obtain.

Clearly, a participatory approach involving local expertise, as discussed later in this chapter, may contribute to the quality of the assessment from a socio-economic as well as an environmental perspective. This holds particularly in case the livelihood basis for local people extends over a large territory: knowledge about ecosystems, biodiversity, and their roles in the livelihood strategies of local populations may contribute to the quality of the SEA.

A major step forward can be made by the systematic combination and mapping of already available knowledge. This strategy has been pursued in the Corredor Norte SEA (see Chapter 6 by Van Barneveld) which resulted in the creation of an atlas with environmental maps and figures. Alternatively, the Suriname impact assessment (see Chapter 4 by Van der Beek, Lassche and Molendijk) has made use of a map including an inventory of all available one-hectare Fisher's alpha diversity indexes for trees collected from a survey of studies (Van Dijck 2013 Chapter 8). The system may be complemented by inventories of other flora and of fauna. A full inventory is hard to realize but probably not required in the context of a SEA.

Different biodiversity sampling methods are in use ranging from the classical approach of floristic inventory to rapid assessment by identification of morphospecies by locals (parataxonomists). Indica-

tor species may be used as an efficient approach of biodiversity assessments. Measurements of biodiversity and eco-systems may be confined to representative sample areas, the number of which depends on the complexity of the ecosystems and ecological diversity of the area. By means of extrapolating and interpolating data from the sample area distribution patterns and boundaries of ecosystems may be assessed. To be useful in the context of a SEA the study needs to focus on key areas and key aspects of the hierarchy in ecosystems.

The ecosystem approach may be helpful in the context of a SEA type of assessment. This approach is appropriate to understand and manage the functioning and dynamics of natural systems as it encompasses the interactions between its components. Ecosystems interconnectedness is the most important issue in conservation ecology as species move in a wide range of habitats. Road construction potentially causes fragmentation and disconnection, which is observable at the level of ecosystems and landscapes. Methods to identify priority areas should focus at the level of ecosystems (Van Dijck 2013 pp 64-68). More advanced forms of assessments of biodiversity at the level of ecosystems may be built upon remote sensing, GIS and GIP. See for instance the investigations by Pita Verweij into the environmental impacts of roads including (illegal) hunting in French Guiana. Satellite images supported by field studies in representative sites and sample areas may facilitate the creation of ecosystems maps at the required level of detail.

When assessing the monetary value of environmental goods and services a distinction need to be made between direct use values, indirect values, option values and existence values. Whereas direct use values are in principle reflected by shadow prices of timber and non-timber forest products, and marketable eco-services like habitat functions and eco-tourism, the valuation of indirect use values is more complex. However, it needs to be observed that market prices may be distorted and relative scarcities may change rapidly, thus limiting the value of prices as a basis for long-term planning as is the case in road construction. Indirect use values may be inferred from revealed preference techniques and stated preference techniques, the two most frequently applied approaches (Van Dijck 2013, pp 68-77). Valuation of eco-system services may become more significant as part of land use planning and policies and in the context of the selection of optimal road trajectories if payment systems such as REDD and REDD plus would be activated. Nevertheless, economic valuation of ecosystem services in the context of a comprehensive SEA is probably not achievable in view of time and budgetary constraints.

Participatory approach: requirements and potential contributions

The participatory approach involving local stakeholders – that is: inhabitants of the potential impact area or their representatives – may contribute to the information collected in support of the SEA, and hence to the quality and comprehensiveness of the analysis and its strategic action plan. Moreover, it may help to strengthen potential contributions of a road to the local socio-economic development and help to limit negative impacts on the environment and its implications for local communities. The concept of participatory approach is ambiguous and may imply different degrees of involvement of local stakeholders, as reviewed by Van Barneveld in Chapter 6. Consultations of the communities may range from information exchange with representatives and selected local stakeholders to a representative survey among the local populations in which their preferences and priorities for a strategic action plan are assessed.

Among the many countries and financial institutions that require a SEA prior to the construction of infrastructure, several insist on some degree of participation of local communities or their representatives. However, specific requirements differ as is clearly the case with the IDB and CAF (Van Dijck 2013, Chapter 4). According to World Bank regulations, in case of indigenous peoples living in the impact area, free, prior and informed consent is required.

The strategic action plan that results from a SEA is supposed to reflect priorities and concerns of the communities in the impact area. Lack of knowledge or information may hamper their full participation in the decision-making process. They may have only little information about the planned intervention like the construction of a road, and/or little knowledge of its potential or probable effects for a variety of reasons: lack of general knowledge, skills, interests, or experience. It should be noted that even to the decision-makers and those responsible for the execution of the plan, the intensity and spread of impacts are hardly known *ex ante*. Modelling of impacts and the spatial spread of impacts as discussed in Chapter 4 is not standard practice in SEAs. These limitations negatively affect the value and relevance of perception studies among local communities in the impact areas, and the results of representative surveys.

Perceptions of probable impacts may differ strongly among members of communities. Official representatives of communities, non-governmental organization and economic agents all have widely different interests and perceptions. Hence, involving only representatives may cause biases in the impact assessment and the strategic plan of action. A representative survey among the members of the community may be the solution.

To facilitate the participation of local communities in the decision-making process, GIS maps with relevant information concern-

ing potential impacts on the livelihood of local communities can be made accessible by means of EduGIS or other systems of digital information sharing, as put in Chapter 4. Relevant spatial information in GIS maps on land ownership, formal and informal (indigenous) lands rights, logging or mining concessions, and the location of planned roads can be made available and accessible to all. The advance of internet, even in remote areas, facilitates the use of such maps. An example is the EduGIS website (www.edugis.nl). Moreover, results of modelling studies of impact areas can be visualized to explain local communities what impacts may affect their lives in the course of time. Ultimately this may result in adjustments in the plans or complementary measures.

The process of (local) knowledge dissemination can be put one step further by visualizing in a short movie the results of an economic-spatial model that simulates the development of an impact area on the basis of the data created for the GIS maps. Such a model-based presentation provides local communities but also policy-makers and those in charge of the project development with a more precise impression of potential impacts on livelihoods, land use and ecosystems. The full experiment was tested in the context of a SEA-type study in Suriname by Van Dijck and others (see Chapter 4 and Van Dijck 2013, Chapter 8).

Arranging an adequate policy context

Decision-making concerning the implementation of the infrastructure programme itself as well as the strategic action plan may be allocated over different levels in the hierarchy of institutions on the basis of the subsidiarity principle. This principle aims at regulating authority within a decision-making system at the optimal level, that is: at the lowest level of subunits of that system that encompasses the boundaries of the policy-driven solution. The principle can be applied within a nation state as well as in a system of nation states.

For application of the principle of subsidiarity in Germany and in the European Union see Wende et al. 2004, Birn et al. 2005, and European Commission 2005. A key component of this approach is assessing the efficacy of policy initiatives at various levels of governance. Design and development of the infrastructure plans like roads may be the responsibility of national governments or governments of neighbouring countries involved in the international road link, while decisions within countries may be allocated among a hierarchy of national and provincial institutions. Issues related to border areas and cross-border initiatives may be allocated to specific groups of institutions operating in border areas such as Zicosur, the MAP initiative and PADIF.

Effective and efficient application of the principle of subsidiarity requires a thorough assessment of the capabilities of the institutions involved in the process. These institutions may need institutional strengthening in order to be effective, which could be part of the action plan. In case of mega-transport corridors that trespass large territories and involve many sectors, a central or regional high-level government authority may need to be appointed to coordinate and supervise the implementation of the action plan, and to represent the organizations in charge of implementation at the highest levels of government.

The SEA related action plan is not a single package for the road as a whole, but consists of groups of proposals that are differentiated according to their nature, scale and geography. Territorial planning has to be an essential element of the strategic action plan to create a framework to optimize the impact of the infrastructure programme. In view of the long term of the actual implementation of infrastructure programmes and related actions, institutional requirements for consistent and continuous execution may be high. This, indeed, appeared to be a weak dimension of governance in the assessment of SEAs according to the study by Kis Madrid et al. (2011).

Road-related action may be formulated in the context of the sustainable development planning framework of national or regional governments. In designing action plans, coordination with the national and regional development planning authorities and organizations is paramount, particularly in the case of corridor infrastructure over large distances with potentially large impact areas. Clearly, SEA-related strategic action plans are as such no regional development plans but should be reinforcing plans and policies of national and regional governments and the private sector. See Chapter 2 by Buitelaar and Chapter 6 by Van Barneveld.

Establishing linkages between SEAs and regional and multilateral treaties

All countries in Latin America have developed rules, regulations, and laws on environmental impact assessments, either inside or outside the framework of international conventions. Some agreement among the parties on the type of rules, standards, and approaches may be useful or required to support efficiency in protecting the environment inside and outside the impact area. Specifically in border regions, an integrated or harmonized approach of biodiversity conservation may be useful. Protection of migratory species may be another case in point.

Regional and multilateral treaties and conventions may contribute to framing government interventions and actions, national policies

and plans in support of sustainable development, particularly in countries with large territories that are of significance from an environmental perspective. This holds also for SEAs and related plans of action related to such environmentally significant territories.

A general and area-wide case in point is the Amazon Cooperation Treaty (ACT). The Strategic Plan for the period 2004-2012 of the Amazon Conservation Treaty Organization (ACTO) expresses the shared topics of concern, including transportation, electric power and telecommunication as a programmatic area. Among the potentially significant achievements of the ACT is the Tarapoto Process on Criteria and Indicators for the Sustainability of Amazon Forests, facilitating the joined monitoring, evaluation and reporting on development of the forests.

Options for bilateral and multilateral cooperation

A range of options is available for countries that participate in a common infrastructure programme like IIRSA/COSIPLAN or another transboundary hub to cooperate among themselves and to create a policy framework in order to arrange the conditionalities and requirements for using an EIA or SEA or specific environmental policy instruments. These options differ in governmental requirements, implications for degrees of national policy space, significance to achieve stated objectives, and efficiency in terms of capability to avoid unintended negative by-effects of the use of selected policy instruments. The range may include policy dialogue as an option reflecting a low degree of commitment in cooperation and harmonization; mutual recognition of environmental standards or assessment standards; permission for partners to use national instruments combined with the requirement to abide to them. These agreements affirm full respect for each party's constitution and recognize the right of each party to establish its own standards. Promotion of compliance is the main issue in this approach (Van Dijck 2000).

A regional or multilateral approach to create a policy framework may indeed contribute to harmonization of national legislation but need not necessarily do so. The multilateral approaches relevant in this context are voluntary to a high degree and leave much space for national policy space. The Espoo approach is an interesting case but may be criticized for contributing little to regional harmonization (Koivurora 1997).

Harmonization may be effective and efficient to protect the environment, particularly in border regions, in cases of cross-border environmental impacts, and with regard to migratory species. However, it is not necessarily the most efficient or the optimal approach as societies differ in their preferences for private and collective goods and services and the quality of their environment. At the same time it

should be noted that so-called harmonization can take many different forms and relate to different approaches such as harmonization of rules, policies, or principles (Leebron 1997). Moreover, harmonization may refer to specific rules and procedures that regulate the outcomes of investments in infrastructure, or the performance of infrastructural programmes, for instance regarding environmental impacts, specified according to types of impacts, and with quantitative criteria for different types of pollution. Harmonization may also refer to environmental policy objectives as formulated by governments.

Such objectives may be defined loosely or specifically, and relate to the state of the environment, the preservation of species, or protection of endangered species. Similar objectives may be defined pertaining to the protection of ethnicities, tribes, cultures, and types of livelihoods. Also, harmonization may refer to specific principles that may underlie policies or selection of rules.

Regarding the policy context of SEAs and their linkage with international treaties the Espoo Convention on Environmental Impact Assessment in a Transboundary Context, in combination with the SEA Protocol of Kiev, is of interest. That combination could be a stimulating starting point for the creation of a regional protocol in Latin America on EIAs and SEAs, for instance in the context of UN-ASUR/COSIPLAN. Such a protocol may facilitate handling transboundary environmental problems and conflicts.

Espoo Convention

The Espoo Convention aims at realizing international cooperation prior to the execution of infrastructural works with transboundary impacts. Signatories are obliged to implement national EIA procedures and to apply a system of permits and licenses. The concept of environment is defined broadly, encompassing public health and safety, flora, fauna, the soil, air, water, climate, landscape, historical monuments, and other physical infrastructure, cultural heritage, as well as socio-economic conditions that may be affected by the infrastructural project to be introduced (Article 1 paragraphs 6 and 7). Critical obligation for the signatories of the Convention is to take appropriate and effective measures to mitigate negative transboundary effects of the infrastructure project on the environment, defined as above (Article 2 paragraph 1). The types of activities that require a national EIA system and mitigating interventions are specified in Appendix 1. National EIAs are participatory by providing residents opportunity for consultation, and require preparation of EIA documentation, as described in Appendix 2, Article 2.2.

Countries are required to notify parties including governments of nations that potentially may be affected negatively by the intended infrastructural activity (Article 3 paragraph 1). On the basis of the

impact assessment and documentation, the government that intends to introduce the infrastructural works must start without delay negotiations with the government(s) of countries that probably will be impacted negatively by these works on the transboundary effects and mitigation thereof (Article 5). For a presentation of the new and comprehensive approach of impact assessment in the European context see Marsden and De Mulder 2005.

SEA Protocol of Kiev

The signatories of the Espoo Convention ratified the SEA Protocol of Kiev in 2003. This Protocol to the Espoo Convention is the first comprehensive international legal instrument that deals with environmental considerations in the context of plans, programmes, policy, and legislation. It may be regarded as complementary to the Espoo Convention which is limited to environmental considerations related to physical projects like infrastructure. When dealing with the impacts of infrastructural works, the SEA Protocol deals with impacts within the national boundaries of the country that is introducing the works, bypassing to a large extent transboundary effects.

According to Article 2 paragraph 6 of the Kiev Protocol, a SEA is seen as the assessment of the probable impacts on the environment, including public health, and requires as well a participatory approach and the inclusion of the outcomes of an environmental assessment in an action plan or programme. The ultimate objective of the SEA Protocol is the realization of a high level of environmental protection by ensuring that environmental considerations are included in the development of plans and programmes; in policy and legislation; by laying down clear, transparent and effective procedures for the execution of a SEA; by making provisions for public participation in the SEA; and by integrating environmental considerations in support of sustainable development (Article 1).

Article 10 of the Kiev Protocol deals with transboundary consultations and indicates that “Where a Party of origin considers that the implementation of a plan or programme is likely to have significant transboundary environmental, including health, effects or where a Party is likely to be significantly affected so requests, the Party of origin shall as early as possible before the adoption of the plan or programme notify the affected Party.” This notification involves the draft plan and programme and the environmental reports. According to Article 3 “The affected Party shall, within the time specified in the notification, indicate to the Party of origin whether it wishes to enter into consultations before the adoption of the plan or programme and, if it so indicates, the Parties concerned shall enter into consultations concerning the likely transboundary environmental, including

health, effects of implementing the plan or programme and the measures envisaged to prevent, reduce, or mitigate adverse effects.”

Principle of subsidiarity

In practical terms the principle of subsidiarity may be useful to distinguish policy areas where combined bilateral initiatives may be an effective and efficient approach to tackle effects of the construction of the road. In cases where effects are local and domestic, there is need for intervention and governance at the local level, but transboundary effects may probably be addressed effectively and efficiently by means of bilateral initiatives at the local, regional or national levels of governance. Pollution of border rivers and transboundary water flows are among the classical examples of the usefulness of the application of the principle of subsidiarity. However, differences in institutional capabilities may thwart a rigorous application of this principle in a bilateral context. Moreover, political complications at the level of national governments may impact on the selection of optimal levels of governance.

Convention on Biodiversity

Apart from the two treaties referred to above, the Convention on Biodiversity (1993) also deals with procedures regarding environmental impact studies. The Convention (Article 14 paragraph 1) requires treaty parties to introduce adequate procedures regarding environmental impact studies. Such procedures need be applied in case of projects with a potential negative impact on biodiversity in order to minimize such impact (sub a). Moreover, countries are required to make arrangements to take potentially negative environmental effects into consideration (sub b). The Conference of the Parties, the executive body of the Convention on Biological Diversity, needs to make arrangements regarding liability for damage to biodiversity, as well as measures to restore or compensate such damage, unless damage is strictly a domestic affair (Article 14 paragraph 2). For information on the ongoing programme on impact assessment see www.cbd.int/impact/whatis.shtml.

At the request of the Conference of the Parties (2006), the scientific bureau of the Convention on Biodiversity (Article 25), in cooperation with the International Association for Impact Studies (IAIA), has established not legally binding guidelines for environmental impact studies. These guidelines may assist countries as a point of reference for incorporating biodiversity in their procedures for EIAs and SEAs. Consequently they may contribute to some harmonization in national procedures for impact assessment (Matz-Luck 2007).

The Ramsar Convention was the first multilateral framework agreement for the preservation of natural resources at the global

level. The Conference of the Parties agreed in 2002 on guidelines (included in an Annex to Resolution 8.9) regarding the incorporation of issues related to biodiversity in environmental impact studies. Such guidelines had been agreed upon earlier in the Convention on Biodiversity and are referred to as the Ramsar specifications when applied in the context of the Ramsar Convention.

The Convention on Migratory Species of Wild Animals (1983) does not include specific requirements with respect to the execution of environmental impact studies. However, the Conference of the Parties accepted in Bonn in 2002 a resolution which emphasizes the significance of comprehensive and advanced EIAs and SEAs. Moreover, members are advised to follow the guidelines of the Convention on Biodiversity regarding the inclusion of issues related to biodiversity in EIAs and SEAs (CMS Decision 6.7, The Hague 2002). These are similar guidelines as referred to in the Ramsar Convention and relate particularly to the first stage of the environmental impact study involving screening and the scoping of a more extensive study. See CMS Resolution 7.2, Bonn 2002).

Final observations

By way of conclusion we may observe that local, regional or national governments need to improve protection of their public goods or the environment that is providing public goods by improving the functioning of SEAs, within or outside the context of local and regional planning. Particularly when infrastructure is constructed in areas rich in biodiversity and with a high potential value in terms of public goods, and with weak governmental mechanisms to enforce the law, SEAs have a major role to play. Primarily, good governance in this context is related to clear and strict procedures and their enforcement. Optimal timing is probably the most significant in that regard, followed by requirements concerning a participatory approach. Moreover, governments may strengthen their legal system to protect the national environment by linking their national rules and regulations pertaining to environmental impacts of economic activities to internationally negotiated and accepted standards and regulations. Also, they may improve the functioning of the SEAs by participating in or adhering to internationally accepted and functioning rules pertaining to the functioning and (minimal) requirements of SEA-related procedures. Multilateral and domestic financial institutions could consider the realization of these procedures and requirements as a conditionality for financing.

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Amazonia is going through a large-scale and probably irreversible transformation process. The size of territories in use for small-scale and large-scale mining, cattle raising, agricultural production and timber logging is expanding rapidly. These activities are supported by a rapidly increasing network of roads and an expanding system of (hydro) energy supply. Flows of migrants are looking for new employment opportunities and income to start a new life in settlements and service centres throughout the region. Hence, amidst the largest forest on earth a new resource-based economy is being developed. As a consequence of these interrelated developments, large-scale land use change and deforestation are taking place. In view of improved accessibility of the area and growing world demand for (processed) natural resources, the anthropogenic pressure is expected to increase further in the years to come.

This Cuaderno del CEDLA focuses on these recent socio-economic developments in Amazonia, in particular on: the diversity among municipalities, provinces and regions in socio-economic levels of development and speed of transformation; spatial and environmental modelling of potential impacts of such developments on future land use and deforestation; and the potential contributions of strategic environmental assessments (SEAs) of (road) infrastructure.

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