

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/envsci

Our common future? Cross-scalar scenario analysis for social–ecological sustainability of the Guiana Shield, South America

Jayalaxshmi Mistry^{a,*}, Céline Tschirhart^a, Caspar Verwer^b, Rob Glastra^b, Odacy Davis^c, Deirdre Jafferally^c, Lakeram Haynes^d, Ryan Benjamin^d, Grace Albert^d, Rebecca Xavier^d, Isabella Bovolo^c, Andrea Berardi^e

^a Royal Holloway, University of London, Egham, Surrey TW200EX, UK

^b IUCN National Committee of The Netherlands (IUCN NL), Plantage Middenlaan 2K, 1018 DD Amsterdam, The Netherlands

^c Iwokrama International Centre, 77 High Street, Kingston, Georgetown, Guyana

^d North Rupununi District Development Board, Bina Hill, Annai Central, Region 9, Guyana

^e The Open University, Walton Hall, Milton Keynes MK7 6AA, UK

ARTICLE INFO

Keywords:

Participatory scenarios
Cross-scalar
Guiana Shield
Guyana
indigenous
Stakeholders

ABSTRACT

Scenarios help build a shared understanding of potential futures and allow us to engage with how interventions or activities may impact on people and the environment. There are many scenario sets that have been developed at the global and regional level, but to a lesser extent at the national and local levels. Yet fewer studies have explicitly linked imagined futures at different social–ecological scales. In this paper, we discuss how scenario analysis was used with indigenous communities and national level stakeholders in Guyana, South America, to explore context specific futures in relation to linked social–ecological systems. These futures were then analysed against published regional (Amazonian) and international scenarios using a qualitative coding approach and supported by quantitative factorial analysis. This allowed us to develop a matrix of multi-scalar scenarios, showing how scenarios at all scales interact. From this, we were able to identify virtuous and vicious cycles amongst the different scales where developments produced feedbacks to make situations worse, better or counteract change at other levels. Our results show that there is considerable mismatch between the different scales of analysis, with the national scale playing a key role as mediator. In addition, we highlight the importance of focusing on the root causes shaping futures as well as participatory forms of scenario development in order to provide better policy and decision support, and stimulate engagement at all levels of organisation in the process of change.

© 2014 Elsevier Ltd. All rights reserved.

* Corresponding author. Tel.: +44 0 1784 443652; fax: +44 0 1784 276647.

E-mail addresses: j.mistry@rhul.ac.uk (J. Mistry), celine.tschirhart@rhul.ac.uk (C. Tschirhart), caspar.verwer@iucn.nl (C. Verwer), rob.glastra@iucn.nl (R. Glastra), Isabella.bovolo@ncl.ac.uk (I. Bovolo), andrea.berardi.ou@gmail.com (A. Berardi).

<http://dx.doi.org/10.1016/j.envsci.2014.05.007>

1462-9011/© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

Ecosystem management and governance across the developing world is facing an increasingly unpredictable and dynamic future. Not only are there challenges coming from within society (e.g. fragmentation and unrest amongst ethnic, institutional and socio-economic lines), but also from national and international development policy (exemplified by the explosion in conflicting objectives amongst development finance, from direct investment in extractive industries and infrastructure, to narcotics/terrorism security, free trade and climate change mitigation and adaptation financing). This is overlaid by the rapid change in the natural environment itself with escalating non-linear abrupt climate disruption such as extreme flood and drought events and accelerating natural resource depletions leading to spikes in key commodity prices.

There is, at the same time, recognition that complexity, uncertainty and change is inherent in the management of social–ecological systems and many problems emerging from these situations could therefore be described as ‘wicked’ (Rittel and Webber, 1973; Brown et al., 2010). Wicked problems seem intractable and often involve the convergence of multiple social and ecological crises at different scales (e.g. Berkes and Folke, 1998; Gunderson and Holling, 2002). Part of this complexity arises from different interest groups – public, private, government, community, individual, collective – all vying for their voices and agendas to be considered in decision-making. Effective and more equitable management of social–ecological systems, therefore, requires analysis at multiple levels of governance, their inter-connections and the competing values and perspectives across scales.

This is particularly relevant in the Guiana Shield, South America, a region covering 2.5 million km² extending from Colombia in the west, through to the Venezuelan states of Delta Amacuro, Bolívar and Amazonas, all of Guyana, Suriname and French Guiana, and into the Brazilian States of Pará, Roraima, Amazonas and Amapá (Hammond, 2005) (Fig. 1). As well as containing 10–15% of the world’s fresh water reserves, a highly endemic biodiversity and richness in indigenous cultures, the Guiana Shield is part of the world’s largest contiguous block of tropical forest, characterised by the highest percent of forest cover and lowest rate of deforestation on the planet, which is in stark contrast to the devastating deforestation evident in the southern and western parts of the Amazon basin. As such, the Guiana Shield has been at the centre of emerging new forces acting to modify and/or repartition access to, and exploitation of, its social–ecological systems.

At the forefront are initiatives in the global battle against climate change, such as Payment for Ecosystem Services (PES), as manifested by international programs including Reducing Emissions from Deforestation and Forest Degradation (REDD+). Currently, Colombia, Guyana and Suriname are participating in the REDD+ United Nations readiness process (FCPF, 2013). Although these schemes may hold significant promise for conservation, there are still great uncertainties with regards to which groups will benefit, with some critics arguing that these initiatives may potentially diminish the power of local communities for controlling the management of their own natural resources. For example, procedures of stakeholder consultation which aim to achieve transparency and equal partnerships, and which address issues that affect the rights and capacity of local communities, are still

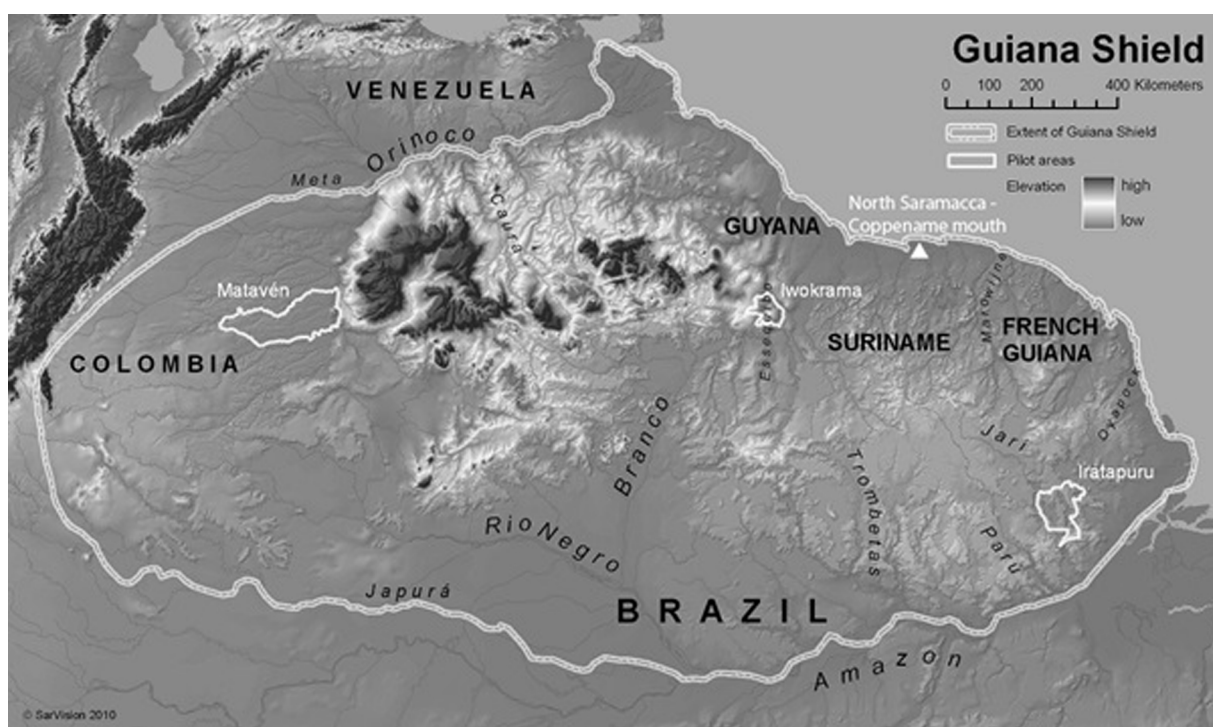


Fig. 1 – Map of the Guiana Shield region.

problematic (Okereke and Dooley, 2010; Martin et al., 2013). Many indigenous groups in the Guiana Shield do not have rights to their traditional land and the resources which are found within these (Colchester et al., 2001; Rainforest Alliance, 2012). When indigenous groups do have land rights, these rarely extend to subsurface rights (Colchester and La Rose, 2010), which are still negotiable and can be potentially revoked, as shown in recent cases in Guyana and Suriname (FPP, 2013). This is in the broader context of relatively inadequate political systems, as reflected by governance indicators such as high corruption, low freedom of speech and low regulatory control (Transparency International, 2013; World Bank, 2012).

Other trends, such as unsustainable practices of mining and land conversion, are widespread in the Guiana Shield (e.g. Hammond et al., 2007; Maughan, 2011), as is the rising and sustained threat of organised crime and/or corrupt groups in co-opting whole regions and communities in supporting the narcotics drugs trade, migration, ill-planned infrastructure projects, and the unregulated expansion of the agricultural frontier (e.g. Ledec and Quintero, 2003; Dávalos et al., 2011). Many of the countries that make up the Guiana Shield fall in the 'medium-high' categories of human development and income (UNDP, 2012), with Brazil in particular becoming a global economic player. Nevertheless, poverty is endemic and indigenous peoples are amongst the poorest and most marginalised communities of the region (Hall and Patrinos, 2005, 2010). Globalisation has also played out in the region, bringing Western values and economies, acting as a homogenising force that can undermine unique indigenous cultures and knowledges, vital for effective social-ecological management.

At present, local communities have had limited voice and representation on the management of the Guiana Shield (e.g. Colchester and La Rose, 2010; Colchester et al., 2001). Yet, developments at the local level, including extreme weather events, such as flooding or drought, will have implications for the evolution of national and international policy, while at the other end of the scale, international policy developments, for example affecting the repartition of natural resources, will have an impact on local livelihoods. Considering the relatively intact status of the Guiana Shield ecosystems, there are still many possible directions in which the region could develop. For example, large and small scale mining, logging and agricultural activities that have been rolled out in the region over the past decades could infer possible future directions. In contrast, international policies directed towards better protection of forests and other natural resources, such as PES schemes, may potentially drive us away from large scale exploitation of the region's natural resources. These are the two extreme visions of the future which regional, national and international decision-makers are contending with.

In light of these threats to, and potential opportunities for, sustainable management of the Guiana Shield ecosystems and its inhabitants, there is a need for a cross-scale, multiple perspective assessment of emerging social-ecological challenges. Scenarios – stories of what might be (Nemarundwe et al., 2003) – can provide a mechanism for such an exploration by building a shared understanding of how interventions or activities may impact on people and the environment. In their simplest form, scenarios can be a vision for the future which

can prepare individuals/communities/institutions for uncertainty and complexity through social learning (Johnson et al., 2012) and by recognising the 'weak signals' of change, preparing for 'living the future' in advance, challenging mind-sets, raising awareness, and stimulating discussion and creative thinking (Ogilvy, 2011).

Although some scenario sets have been carried out at the regional (Amazon, Latin America) level, there have been few studies at the national and local levels within the Guiana Shield. Yet, fewer studies have explicitly linked imagined futures at different social-ecological scales. In this paper, we discuss how participatory scenario analysis was used with indigenous communities and national level stakeholders in Guyana, South America, to develop context specific futures. By evaluating the compatibilities of national and local futures with published regional and international scenarios, we hoped not only to draw on multiple sources of knowledge, but to strengthen community interests within policymaking.

2. Methods

2.1. Study context: Project COBRA

The research on Guiana Shield scenarios took place through the COBRA project – a research project funded by the European Commission 7th Framework programme with the mission to "...find ways to integrate community solutions within policies addressing escalating social, economic and environmental crises, through accessible information and communication technologies" (see www.projectcobra.org). The project involved ten partners across Europe and South America including civil society organisations (CSOs), research institutions, and a small and medium environmental management enterprise. All partners were committed to improve community-based natural resource management in the region. The first phase of the project focused on establishing the viability of indigenous social-ecological systems through the identification of a range of strategies in response to differing environmental challenges and opportunities (Berardi et al., 2012, 2013a). Scenarios were then used to assess the extent to which these current indigenous strategies were 'future proof', thereby allowing the identification of 'best practices' (Mistry et al., 2013a). Therefore, as opposed to a device for planning (through modelling for example), scenarios themselves were not the end-goal in our approach (Evans et al., 2013), but were considered a research tool to provide a future context for framing in-depth qualitative data collected on current responses to environmental challenges.

Integral to the COBRA project was a participatory action research (PAR) approach. A PAR methodology engages a range of end-users in the research process right from the start, building social capital of the participants and allowing reflection and adaption while the research is being undertaken (Kindon et al., 2007; Reason and Bradbury, 2008). As such, the project involved different stakeholders in the process of scenario development and analysis with the objective of identifying where people imagine or want to arrive to in the future (Swart et al., 2004). In addition, the project took a social-ecological systems approach (Berkes et al., 2003), recognising

the deep links between ecological and socio-cultural systems, the nestedness of these systems, and the inherent complexity and non-linearity of processes. Therefore, to allow participants at each scale to articulate their views and opinions, while at the same time linking scenarios between different scales, we took a ‘complementary’ approach to our cross-scalar analysis (Zurek and Henrichs, 2007):

“the logics and assumptions in complementary scenarios differ across scales, but this does not preclude selected information from scenarios at one scale to feed into scenarios at another. The scenarios can differ substantially at the various spatial scales, and even contradict each other—nevertheless by this they also complement each other as they illustrate how an issue may be perceived differently at different scales, or even how issues differ in their relevance” (p.1290).

In the following sections, we outline the scenario process at different scales. At the international and regional levels, a desk-based literature review was undertaken, followed by a consultation process to identify individual scenario sets for the cross-scalar analyses. At the national and local levels, we focused on participatory scenario development for Guyana and the indigenous communities of the North Rupununi. The North Rupununi was the core case study of the COBRA Project; an area where there has been a long history of considerable attention from the government and international donors for

the management of its natural resources (Mistry et al., 2009). Because of the high capacity as well as the mutual relationship of trust that communities have built with international researchers over the past decade, the North Rupununi provides an excellent opportunity to explore indigenous visions of the future and their potential compatibility with the national, regional and international outlook.

2.2. Literature review of international and regional scenarios

There are a broad range of scenario sets from international and regional levels that have been developed by the academic, policy and private sectors, with varying timescales and using a range of processes and participants. A comprehensive review through a desk-based study was carried out on these, while at the same time compiling data and information on emerging trends that could help build pictures of potential future scenarios. Based on their relevance to the development of natural resources and underlying drivers such as climate change and economic choices with large scale impacts, a total of eight sources were selected for further in-depth analysis. Most of these sources have defined several detailed scenarios or scenario groups (Table 1). Additionally, based on their relevance to the Guiana Shield or South America in a broader sense, and their thoroughness, six regional scenarios were assessed in detail (Table 2). The processes and assumptions behind the scenario sets, and the core underlying drivers, were

Table 1 – Global scenario sets used in this study and their sources.

Scenario set	Individual scenarios	Source
Millennium Ecosystem Assessment (MA) (2005)	Global orchestration Order from strength TechnoGarden Adapting mosaic	http://www.millenniumassessment.org/documents/document.329.aspx.pdf
Millennium Project Global Scenarios (2008)	Business as Usual–The Skeptic Environmental Backlash Technology pushes off the limits Political turmoil	http://www.millennium-project.org/millennium/scenarios/energy-scenarios.html
Global Environmental Outlook (GEO4) (2007) ^a	Markets first Policy first Security first Sustainability first	http://www.unep.org/geo/GEO4.asp
Global Biodiversity Outlook (GBO-3) (2010)	n.a.	www.cbd.int/gbo
Intergovernmental Panel on Climate Change (IPCC) (2000). Emissions Scenarios	A1FI A1B A1 T A2 B1 B2	http://www.ipcc.ch/ipccreports/sres/emission/index.php?idp=0
Costanza scenarios (2000)	Mad Max Star Trek Ecotopia Big Government	Costanza (2000)
World Business Council for Sustainable Development (WBCSD) (1998)	FROG! Geopolity Jazz	http://www.wbcsd.org/pages/edocument/edocumentdetails.aspx?id=143&nosearchcontextkey=true
Shell (2005)	Low Trust Globalisation Open Doors Flags	http://www.shell.com/global/future-energy/scenarios.html

^a Note that a newer version was released in 2012 after this study.

then analysed. Summaries of all the scenarios and their analyses can be found in [Mistry et al. \(2013b\)](#).

2.2.1. Process of selecting one scenario set for each scale

Following the review of international and regional level scenarios, we created an expert group to help distinguish which drivers were the most relevant and appropriate to the goals of the project, and then compared these results to the published data. For this, we used an adapted and simplified version of the Delphi technique ([Goodwin and Wright, 2009](#); [Linstone and Turoff, 1975](#)), an established tool for consensus-building. Its purpose is to elicit information and opinions from participants to assist planning and decision making, ideal in the context where a panel of people would participate in the process at a distance, and by email. The expert group was constituted through the project network, comprised of seventeen academics, practitioners and policymakers with both international and regional expertise in the field of sustainable development and natural resource management.

Using examples from well-established scenario building organisations (e.g. Millennium Project), we developed and administered a questionnaire on global and regional drivers to the group, asking:

- How important do you think it is to stress society, technology, environment, economics, politics and values in both global and South American scenarios of change over the next 20–30 years?;
- Taking into account the different categories of society, technology, environment, economics, politics and values, what are your top five global drivers of change over the next 20–30 years?;
- Taking into account the different categories of society, technology, environment, economics, politics and values, what are your top five regional drivers of change over the next 20–30 years?

Respondents were requested to rank their answers in terms of importance and certainty and to provide explanations for

their choices. Future scenarios are typically developed using the most important drivers and the critical uncertainties. Once all questionnaires were completed, we combined quantitative (ranking of drivers) with qualitative (rationalisation of choice) response data. Both at international and regional scales, the expert group highlighted ‘population growth’ and/or ‘climate change’ as the top drivers of change. However, our interest lay in the drivers with high uncertainty (as described by scenario analysis) and both population growth and climate change are generally considered highly certain and inevitable over the next 20–30 years (the timeframe of the analysis). Consequently, in a second round of consultation with the expert group, these drivers were excluded, and attention was drawn to the drivers that would have greater uncertainty.

2.2.2. Linking questionnaire results to published scenarios

Based on the questionnaire results and in order to identify scenarios that strongly integrated at least two of the questionnaire drivers, we used a scoring system to assess the degree to which ranked drivers, and their attached rationale, were present in the published scenarios. Some drivers were very specifically mentioned in the scenarios (determining scenarios axes) whereas in others, the importance was more implicit. Therefore, a score of 2 was given when the driver was explicit and 1 when the driver was present in the narrative but in a more embedded and implied nature.

2.3. Participatory scenario workshops at national and local scales

A review of the literature found that at the Guyanese national level, there were some very context-specific scenarios, for example, climate change and its impacts on the coastal/urban regions (e.g. [Bovolo et al., 2009](#); [ECA, 2009](#); [ECLAC, 2011](#); [McSweeney et al., 2012](#)), but there are no scenario studies that brought together a range of expertise and opinions from across the social and environmental disciplines. In addition, there were no scenario sets developed at the local level, let

Table 2 – Regional scenario sets used in this study and their sources.

Scenario set	Individual scenarios	Source
Latin America Environment Outlook (GEO LAC 3) (2010)	Regulated Sustainability Sustainability Reforms Unsustainability and Increased Conflicts Transition to Sustainability	UNEP (2010)
Environment Outlook in Amazonia (GEO Amazonia) (2009)	Emergent Amazonia Inching along the Precipice Light and Shadow The Once-Green Hell	UNEP & ACTO (2009)
SIM AMAZONIA (2006)	Business as Usual Frontier Governance	http://www.csr.ufmg.br/simbrasil , Soares-Filho et al. (2006)
Millennium Project Latin America scenarios (2012)	God is Latin America Disintegration in Hell	http://www.millennium-project.org/millennium/ScenariosLatinAmerica2030.html
Intergovernmental Panel on Climate Change Latin America scenarios (2007)	n.a.	http://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch13s13-3.html
US National Intelligence Council Latin America 2020 scenarios (2004)	n.a.	http://www.dni.gov/files/documents/Global%20Trends_Mapping%20the%20Global%20Future%202020%20Project.pdf

alone by indigenous groups. We therefore organised scenario workshops at the national level and with the communities of the North Rupununi. We used a participatory approach to develop the scenarios (see for example, Berkhout et al., 2002; Hulse et al., 2004; Kok et al., 2007, 2011; Patel et al., 2007; Enfors et al., 2008; Bohensky et al., 2011; Palacios-Agundez et al., 2013). Our view was that a participatory scenario process could provide a platform for dialogue among different interest groups, learning amongst participants and help develop shared visions to address sustainable development challenges (Johnson et al., 2012).

We followed the commonly used scenario-axes method in which four scenarios were developed around axes of importance and uncertainty (MA, 2005; Groves and Lempert, 2007; Goeminne and Mutombo, 2007). We chose the year 2030 as the endpoint for the scenarios in order to make the scenarios relevant to most participants' actual future and allow them to reflect on their own potential responses to upcoming challenges.

2.3.1. Participatory scenario workshop at national level

At the national level we organised a two day scenario workshop with over thirty participants representing a combination of government agencies, non-governmental organisations, academics and independent consultants. Working in four groups broadly classified as environmental scientists, indigenous representatives, government bodies and government ministries, participants were asked to reflect on the current drivers important for the future of Guyana and what Guyana would look like in 2030. Using the two most uncertain and important drivers, four possible scenarios were developed. However, with limited time, each group were asked to describe at least two of the four scenarios identified. The whole process and results of different stages of the scenario development process are explained in depth in Davis et al. (2012).

2.3.2. Participatory scenario workshop at local level

In the North Rupununi, a three day scenario workshop was attended by thirty-two members of the sixteen communities that comprise the North Rupununi District Development Board (NRDDB) (indigenous civil society organisation representative body). Participants were divided into men, women and youths, groupings that would allow people to honestly present their knowledge, perspectives, and needs, without being influenced by community power relations (Wollenberg et al., 2000; Rawluk and Godber, 2011). Using the two most important but uncertain drivers, four possible scenarios were developed by each group. However, with limited time, each group were asked to describe at least one of the four scenarios identified, and storyboarding (pictorial representations) was used as a technique to develop the narration for each scenario. The whole process and results of different stages of the scenario development process are explained in depth in Jafferally et al. (2012).

During the workshop, all activities and discussions were recorded using video and photos. Participatory Photography (PP) and Participatory Video (PV) (Bignante, 2010; Mistry and Berardi, 2012) are the main methodological tools used in the COBRA project, to facilitate, amongst other things, both

horizontal (between communities) and vertical (to external stakeholders and decision-makers) communication. Following the workshop, participatory films and photostories were developed about the developed scenarios and then through two cycles of community consultations in sixteen villages, the scenarios were presented to wider community members for feedback. The final participatory video films and photostories are available on the Project COBRA Media Gate at <http://projectcobra.org/category/media>.

2.4. The process of cross-scalar analysis

Table 3 summarises the features of the scenarios at different scales. Using the data collected at each scale, all the drivers featured in the narratives and their associated trends, were coded into a database. Then, through a visual mapping exercise, all 101 scenario drivers were organised according to emergent themes. The approach adopted was inspired by Grounded Theory (Charmaz, 2006) where no a priori hypothesis was in place before the mapping exercise took place. Mapping commenced with the local drivers of change, where drivers sharing similar themes were grouped together. This was followed by national drivers, and then regional and international level drivers. The process involved extensive discussions between researchers over three iterative cycles of analysis. This resulted in a set of cross-scalar themes from which cross-scalar interactions could be identified.

Since there were a large number of scales, themes and trends involved in the analysis, and to triangulate the initial qualitative assessment, we performed a Factorial Correspondence Analysis (FCA) on the data. Hierarchical Ascendant Classification (HAC) was then carried out on the coordinates of the modalities in the factorial space, considering the first three axes, using the Ward criterion. This criterion is based on the minimum of variance within each class (Lebart et al., 1997; Sanders, 1989). These analyses were carried out using the Statistica 7 software.

3. Results

3.1. Global and regional scenarios for cross-scalar analysis

At global and regional levels, there are generally two extremes of scenario narratives: 1. Market driven world in which environmental degradation continues; and 2. Government controlled world with great environmental awareness and sustainable solutions. Although, numerous drivers are

Table 3 – Data present for each scenario database.

Scenario sets	Scale	Number of scenarios	Number of drivers
GEO4 Global	International	4	21
GEO Amazonia	Regional	4	16
Guyana Scenarios	National	8	38
North Rupununi Scenarios	Local	8	26

featured in the published scenarios (see Table 3 for instance), Table 4 shows that the most important factors driving scenarios at the global level are globalisation, governance, ecosystem management and land use, and technology. Correspondingly, the expert group also ranked globalisation and ‘overconsumption’ of natural resources as their top drivers of global change (see Table 5). On the other hand, the expert group emphasised the importance of values, described as the basis of human decisions, particularly around social–ecological system governance.

At the regional scale, published scenario sets highlight socio-economics, globalisation and technology as key drivers. Although the expert group related mining (one of their top drivers) to a globalised market, governance was highlighted as critical to the extraction of natural resources, ecosystem management and land use in the Guiana Shield, and many responses focused on large infrastructure, such as dams, as a threat to the region in the future.

Comparison between the expert group responses and the published scenarios showed that at the global scale the MA Scenarios take 2 out of the top 4 drivers quite strongly into account, but values are only indirectly touched upon. The GEO4 does not explicitly take globalisation into account, but it is strongly implied in its economic and social drivers, in terms of levels of intervention. GEO4 therefore take 3 out of the top 4 drivers quite strongly into account. At the regional level, GEO Amazonia and SIM Amazonia are the two scenario sets that best represent the respondents’ views. SIM Amazonia has strong scores for 2 out of 3 drivers. However, it does not integrate the top driver of mining. The GEO Amazonia takes into account all 3 drivers. Therefore, the GEO4 and GEO Amazonia (summarised in Appendix A) were used in the cross-scalar analysis.

3.2. National and local level scenarios for cross-scalar analysis

Table 6 indicates the two most important and uncertain drivers used by each group at national level to develop their scenario narratives. Other drivers were incorporated into their storylines. Table 7 presents the individual scenario narratives.

At the local level, women’s concerns and uncertainties lay around the continuation of the NRDDDB as an institution and the kinds of values people would have in the future. For the men, mining, specifically oil, and issues of governance were key future priorities. The key concern for the young people was the lack of opportunities in the region and local governance challenges. They expressed these uncertainties in the form of recreational facilities for youth in the communities. Fig. 2 illustrates examples of scenario storyboards, while Table 8 presents the individual scenario narratives.

3.3. Cross-scalar results

Mapping the drivers of change within scenarios across scales resulted in an agreed final classification comprised of fourteen themes (Fig. 3). These were: Values; Participative Democracy; Corruption; Public policies; Social policies; Environmental policies; Cohesion with other communities; Dominant

stakeholders; Dominant scale; Markets approach; Investments in infrastructure; Approach to innovation; Energy; and, Aid. The themes that were mentioned mostly at the local level can be found more towards the centre of the diagram (e.g. ‘Cohesion between communities’ or ‘Corruption’). Themes such as ‘Markets approach’ and ‘Aid’ were mostly mentioned at the highest levels. This diagram shows that themes related to governance are in great majority.

Studying the linkages present within the different themes enabled us to begin making tentative cross-scalar interactions (Table 9). Already at this stage, certain cross-scalar synergies and incoherencies became apparent. Overall, only three out of the fourteen themes are covered at all scales; social policies, environmental policies and dominant stakeholders. Most gaps are identified at the regional level (seven gaps), which often seems to create a break between the local and the international levels. Six gaps can also be identified at the local level, which seems to highlight clear incoherencies in focus areas between the local and the highest scales. The global level scenarios seem to cover most themes, but are strongly characterised by ‘Aid’, a theme that is not covered at any other scale. Investment in infrastructure is specific to the national level. The theme that features strongly at the local level but is not taken into account at other scales is ‘cohesion with other communities’. Finally, there seem to be synergies, from local to global, on policy and governance themes. However, themes related to markets, innovation and energy seem to be only a ‘high’ level concern (from national to international).

Similar results were found from carrying out FCA on our datasets. The first three axes accounted for 42.7% of the total inertia of the data. Interpretation of these axes (following Sanders, 1989 and Lebart et al., 1997) show that Axis 1 relates to local scale vs. global scale, Axis 2 is bound to ‘worst’ case vs. ‘best’ case scenarios, and the weaker Axis 3 is linked to regional (and rather negative) scenarios versus ‘intermediate’ (between ‘worst’ and ‘best’ case scenarios) global scenarios. This third axis might be underlining main incoherencies between regional and global scales. In our HAC analyses, the first cut-off point used for distinguishing classes was ten classes. By going through each class individually, similarities and inconsistencies were identified which led to the aggregation of some classes and a final number of seven. These HAC classes were then overlaid onto the FCA to visually display the results (Fig. 4). Using both the qualitative and quantitative analyses, a typology of the cross-scalar scenarios was produced (Table 10). These provide examples of cross-scalar win–win, win–lose and lose–lose scenarios.

The win–win scenarios from the North Rupununi to the Guyanese scales involve low corruption and high participative democracy (Class 3). These focus areas are completely absent at the regional scale. At the global level, only the ‘Sustainability First’ scenario (present on its own in Class 5) involves high participative democracy. Some national and regional scenarios seem to find synergies on the themes of good social policies, good environmental policies, even balance of power between stakeholders and scales (but with the government slightly dominating), dynamic approach to innovation and high investment in infrastructure. However, as we see, these best-case scenarios might not develop into a

Table 4 – The scenario sets reviewed in this study (left column) and the key drivers that underlie the differences between scenarios (top row).

	Socio-economics, Poverty reduction, Equity, Human well-being	Globalisation, Degree of market liberalisation	Governance	Geopolitics and global security	Ecosystem management and land use	Infrastructure projects e.g. roads	Cultural values, Community sense vs Individualism	Demography, population growth	Technology	Climate change
Global level scenarios										
Millennium Ecosystem Assessment		X			X					
Millennium Project (Global Scenarios)		X	X	X					X	
GEO4 Global GBO-3			X		X X		X			X
IPCC Costanza scenarios	X				X		X	X	X	
WBCSD Shell			X X						X X	
Regional level scenarios										
GEO Latin America	X	X			X					
GEO Amazonia		X	X			X			X	
SIM AMAZONIA	X					X				
Millennium Project Latin America scenarios	X								X	
IPCC Latin America scenarios		X						X	X	
US National Intelligence Council Latin America 2020 scenarios			X	X						

Table 5 – Top global and regional drivers from questionnaire analyses, including example quotes explaining choice and ranking.

Drivers	Explanations for choice and ranking
Global level: Overconsumption (of natural resources)	<p>International consumption as countries become developed will continue to grow putting pressure on natural resources. Global capacities are the main limiting factor; most are at or near tipping point.</p> <p>The decrease in the rate of population growth is offset by the increase of consumption by the world population. The externalities associated with consumption and over population stress natural systems that provide crucial environmental services and change our environment to a degree where it may not be livable for our society anymore.</p>
Globalisation	<p>Disposable consumption culture must end. Causes over-exploitation of world's resources/economic instability</p> <p>Main threat to loss of cultural diversity.</p> <p>A political-economic process that dominates most other drivers.</p>
Values	<p>Negative impact globally. Values are at the core of all our decisions and increasing individualism leads to many problems and hampers finding solutions for global problems.</p> <p>'Values' is for me by far the most important factor which drives progress. Indeed, this very exercise in ranking is a good example of how 'values' determines choice. In South America, and with indigenous communities in particular, the greatest challenge that they have faced is a confrontation between their traditional value systems (holistic, Earth centred, cooperative) and the value systems of the West (reductionist, anthropocentric, individualistic, competitive). Scenarios should certainly reflect the dominance of different value systems. Will it be more of the same in the future, or, will we rapidly evolve a new value system?</p> <p>I think that if the dominant value at the global level, if the value that is actually favoured, is "survive the fittest", individual development at the possible expense of others (other countries, other people), it can possibly drive to the worst-case scenarios.</p> <p>I would argue that this [governance] is a "values" issue rather than a "politics" one, and a subset of the individualist/egalitarian gradient. Bad governance is a result of an extreme in individualism.</p>
Regional level: Mining	<p>Including oil, gas & energy generation infrastructure.</p> <p>Gold mining is currently the most important driver change in the GS [Guiana Shield]. The second one is bauxite, especially in Guyana and Suriname, and it seems that the Chinese are now also looking for manganese in Southern Suriname.</p> <p>Expansion of foreign mining companies.</p>
Governance	<p>Mining is one of the greater factors in the region's exploration and will increase in importance as congress [reference to Brazil] creates the regulatory framework for allowing mining in indigenous territories. Non-transparency of the political system leads to corruption and lack of accountability and lack of law enforcement (police/army etc).</p> <p>I think bad governance is one of the key drivers of change for the next decades at the regional level. I believe that with good governance even the toughest environmental situations can potentially be handled. Furthermore, even with the best political intentions, these cannot be effective if there is no good governance.</p> <p>Due to bad governance mining, oil and gas and expansion of biofuel crops risk to deteriorate the regional system.</p>
Infrastructure	<p>The lack of governance in the region will make it vulnerable to degradation of its natural resources whether through uncontrolled extraction of timber, mining or through the creation of roads into its interior. Driver of deforestation.</p> <p>The building of roads, railroads, bridges, hydropower stations and the diversion of rivers to "feed" the hydropower lakes, and transmission lines the GS [Guiana Shield], are and will be major drivers of change. This infrastructure is associated with the transportation of the minerals mentioned below and with the need of Brazil to transport its agricultural products to the Caribbean ports.</p> <p>Access roads, large-scale incursion.</p>

Table 6 – Drivers of high importance and uncertainty used by the different groups for scenario development at national level.

Group	Drivers
Environmental scientists	Renewable Energy development Natural resource management
Indigenous representatives	Mining, namely oil exploration Community spirit and values
Government agencies	Continuity and effective enforcement of policies Transparent and accountable government institutions
Government ministries	Mining, namely oil exploration Agricultural diversification

win-win situation at all scales, if, at the local level, governance issues are not dealt with.

Considering the major gap identified between the local-national scenarios on the one hand, and the regional-international scenarios on the other hand, it becomes clear that win-lose situations could easily develop. Interestingly, it could be plausible that negative developments at the highest levels have relatively limited impact at the North Rupununi scale if the Guyanese government remains disarticulated from these drivers. One possible win-lose scenario could be the development of the Security First scenario at global level (class 6), leading to rather negative developments at the regional level (e.g. Inching along the Precipice scenario, class 6). However, this would not necessarily lead to negative developments at the Guyanese level depending on how the government manages the discovery of oil or its agricultural

diversification (Class 4), an attitude which can then easily trickle down positively to the North Rupununi level.

The opposite situation could also very easily occur: positive developments at the highest levels could be blocked on their way to the national and local levels because of governance issues. Here again, the trickling process between the Global level ‘Sustainability First’ (Class 5) and the local worst-case scenarios (in Class 1) goes through the national level scenarios ‘Guyana finds Oil but there is no agricultural diversification’ and ‘Guyana has no Oil and there is agricultural diversification’. In other words, the key player in these win-lose pathways is the national government.

From the North Rupununi to the Guyanese scales, lose-lose scenarios involve individualist values, a poor participative democracy and high corruption, poor social policies and little focus on the environment. Dominant stakeholders would be private, the dominant scale would be national (with little consultation at local scales), low investment in infrastructure and a poor focus on energy solutions and development. Transparency, benefit sharing, political continuity are crucial for the future of the country and its peoples.

Although falling in a different class because of a very distinct overall profile, the only scenarios at higher scales that mention a poor participative democracy, individualist values and poor social policies are “Markets First” and “Security First”. Although Markets First has a slightly better approach to environmental policies and energy, the link to local scales is very poor as the preferred scale is international (and international markets). Security First, on the other hand, is possibly the worst-case global scenario in most aspects. Even if the government is presented as the dominant stakeholder, it

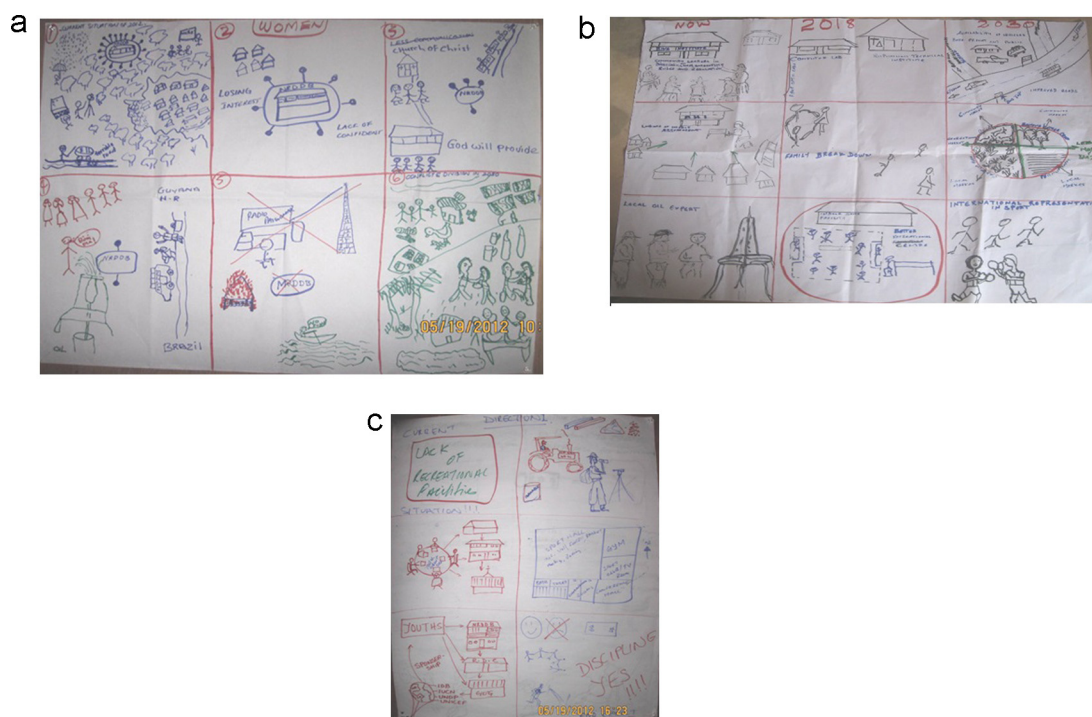


Fig. 2 – Examples of scenario storyboards developed in the North Rupununi, where (a) women’s scenario A of conflict and divide, (b) men’s scenario of oil discovery and development, and (c) youth scenario A of having a recreation facility and it functioning well.

Table 7 – National level scenario narratives.

Group	Scenarios
Environmental scientists	<p><u>What if good natural-resource management practices dominated and there was a low dependence on fossil fuels?</u></p> <p>This is the ideal position whereby there would be, by 2030, a commitment to renewable energy technologies, such as hydro-power, wave energy, geothermal energy and solar power) and their implementation. Capacity building and training at all levels would occur and there would therefore be incentives for companies to retain their trained staff. This would lead to less emigration and to greater in-country benefits. Public campaigns and incentives would increase national awareness so that energy efficiency would increase at the household and community level. Due to good natural resource management and effective use of resources, Guyana would be better off financially leading to better infrastructure development. The government would be accountable for its actions and would therefore govern wisely. There would be a general uptake of new technologies and new facilities for waste disposal and recycling. Wise investments would maximize the sustainability of resources and would foster innovation, therefore research and technological developments would increase. Unknowns which could alter the applicability of this scenario include the discovery of oil and gas, high energy tariffs and non-receipt of Low Carbon Development Strategy^a payments for ecosystem services.</p>
Indigenous representatives	<p><u>Scenario A–What if Guyana does not find oil and individualism dominates?</u></p> <p>By 2030 in this scenario, Guyana would be completely dependent on oil imports. The high price of oil has led to key sectors, such as the private sector, individual business and foreign investors, dominating the oil import market, especially those living close to national border areas. In these same areas, illegal fuel smuggling by criminal gangs prevails. With the increased cost of living, the government is forced to give ease of accessibility through subsidies, but favours those politically aligned with them. This allows political and ethnic divisions to become entrenched in society, leading to civil unrest and local interior communities aligning themselves with bordering nations/communities (Brazil, Suriname, Venezuela). Loss of human capacity and skilled workers to other countries continues, leaving those behind to accept inadequate low paying jobs. Inadequate investment in education and healthcare means there are more school dropouts, the University of Guyana has closed, there are no staff to run major hospitals and there is an increasing ageing and morbid population. The government has increased production and export of minerals and timber to generate revenue and many communities in the interior are overrun by illegal miners and loggers, as well as irreversible environmental degradation. In some areas, there are hydro, bio-fuel and renewable energy projects, but these are generally dominated by private business.</p> <p><u>Scenario B–What if Guyana does find oil and individualism dominates?</u></p> <p>By 2030 in this scenario, Guyana is a divided country of the rich and poor. The discovery of oil and its associated income has led to large financial benefits for the elite and those politically aligned with the government. There is little transparency and accountability of the oil income, while at the same time, investment in sectors such as education, technology, tourism, infrastructure, transport, agriculture and policy reform are neglected. People lack motivation to work and a vibrant black market in goods has emerged. There have been drastic changes in cultural life where prostitution, crime, drugs and human trafficking are norms and people live in ghetto-like districts or in fenced communities. Communities living in close proximity to oil industries, wells or worksites depend entirely on those activities for their livelihoods, and abandonment of traditional lifestyles has increased health problems and cultural loss. In other areas, illegal mining and logging continue and here there is little law enforcement or government intervention, leading to slum communities. Waste disposal issues and oil spills are regularly in the news, but although irreversible ecosystem change is occurring and the international community raises its concerns, the government is self-centred, and has poor relations with its neighbours and Caribbean Community countries. There are small protest movements, but mainly underground and through the Internet, as any protest gatherings are quickly stamped out through police force.</p> <p><u>Scenario C–What if Guyana does find oil and community spirit dominates?</u></p> <p>By 2030 in this scenario, Guyana has realized its motto of 'one people, one nation, one destiny'. The income from oil exports means there is more money to invest in key sectors such as education, infrastructure and healthcare. The University of Guyana is now the Caribbean hub for research and development activities and boasts world-class educational and research facilities. Communities in the interior regions have greater access to vital services and markets. The economy is able to diversify, and technology plays an increasingly important role as a service industry. Advocacy and organised pressure groups demand accountability and stewardship of oil income, and civil society organizations sit on all levels of government hierarchy and decision-making. Specialist groups with representation from all sectors of society have been established to effectively manage and monitor oil extraction activities and the companies responsible. This ensures that environmental issues are at the forefront of government policy and that any waste and spill problems are dealt with quickly and effectively. In addition, while mining and logging activities continue, they are also closely monitored. This all attracts tourists to the country and there is an increasing influx of skilled Guyanese migrants back to their homeland.</p>

Table 7 (Continued)

Group	Scenarios
Government agencies	<p><u>Scenario A—What if Guyana has transparent governments and continuity in policies?</u> The stable governance context allows for the development of PES (Payments for Ecosystem Services) schemes, with considerable payments in the coming decades by countries that want to compensate their high carbon emissions. Sustainable forest management becomes the rule in Guyana and deforestation, land degradation and biodiversity loss remain very low. There is consistency in Guyana's energy policy that moves away from fossil fuels towards renewable and greener sources. Mining continues, but under reduced-impact conditions and with environmental and social safeguards in place. Increased government investment in education leads to stronger institutions and higher education levels, and to a reduction in the brain drain. Government investment in infrastructure also increases, but based on sound land use planning. This improved infrastructure makes the country more attractive to powerful foreign investors in search of land and natural resources.</p> <p><u>Scenario B—What if governments are not transparent and there is no continuity in policies?</u> The lack of continuity and transparency in government policies leads to growing exploitation of natural resources (timber, agriculture, mineral resources) by foreign companies, with little control by government agencies. As a result, land use changes rapidly in some regions, and the rates of deforestation and land degradation increase. These foreign companies do create employment opportunities, but foreign workers compete with Guyanese. With government conditions not favouring innovation and a long-term vision, the country remains dependent on fossil fuels and the implementation of environmental policies is poor. The potential to benefit economically from ecosystem services is hardly utilized and Guyana loses its pioneer position. The lack of innovation leads to a decreased awareness of best practice techniques in resource exploitation and to the use of outdated technologies that affect Guyana's competitive power on the regional and global markets. Since investment in sound land use planning is low, infrastructure development does not consider the need and opportunities to adapt to climate change. The consequences are a loss of agricultural potential, loss of biodiversity and unstable food security. Government policies do little to address the inequitable distribution of resources and wealth, which leads to increased poverty.</p>
Government ministries	<p><u>Scenario A—What if Guyana finds oil?</u> The prospect of finding oil in Guyana is highly uncertain but if it is found it would have a huge impact in Guyana. There are currently oil companies digging exploratory wells offshore however deposits of oil have not yet been found. Assuming oil was found tomorrow, by 2030 positive impacts would include the creation of new training and job opportunities and emerging industries. There would be an influx of foreign exchange following foreign investments and a rapid increase in disposable income. Investment by the oil companies and other associated industries would lead to improved transport and communication infrastructure. Additionally, as oil companies usually bring benefits to the local area when they are established in a country, there may be improvements and expansion of education facilities and improvements in availabilities of green technologies. Generally, there would be an improved standard of living leading to less emigration, and a potential re-introduction of Guyana's diaspora.</p> <p>Negative impacts may occur however, through environmental disasters such as oil spills, and there would be general increases in pollution levels. Guyana's 'green' status may also be negatively affected due to the rapid, high release of carbon from the burning of the fossil fuels, leading to a 'carbon-spike' in Guyana's carbon quota. This may negatively impact Guyana's Low Carbon Development Strategy and affect potential Payment for Ecosystem Services mechanisms and carbon trading budgets. Social values would be negatively impacted due to the rapid increase in disposable income leading to 'social ills' such as prostitution, gambling and alcoholism. Family units would also be disrupted as (traditionally) males would be working away from the family for large amounts of time on oil rigs. Although the oil industry would introduce new skills to Guyana's workforce, other industries, such as mining or agriculture, may find that there are insufficient workers for their needs.</p> <p><u>Scenario B—What if Guyana increases its agricultural diversification?</u> Currently, large sections of agricultural land on the coast are used for sugar and rice production, however the sugar industry is no longer profitable and agricultural land is either going fallow or handed over to new housing schemes. Aiming for agricultural diversification rather than monoculture, would enable Guyana to produce its own food and lower its reliance on food imports giving it food security. It may also be able to export various food items to the rest of the Caribbean and the world leading to increases in GDP. The introduction of new technologies could increase production levels and establish a new knowledge base. Agroforestry would also be established and cleared lands would be rehabilitated or re-vegetated thereby establishing a more productive land use. Agricultural diversification would lead to a rebirth of a cooperative spirit amongst the population and improvements in transportation networks. Negative impacts would be relatively low as most of the land would already have been used for agricultural purposes, however some deforestation or degradation of forested land may occur with associated disruptions of ecosystems if agricultural expansion were to happen.</p>

^a Low Carbon Development Strategy developed by the Government of Guyana to promote a green economy and payment for ecosystem services. For more information visit www.lcds.gov.gy.

Table 8 – Local level scenario narratives.

Group	Scenarios
Women	<p><u>Scenario A – Conflict and Divide</u> If the NRDDDB failed in the future, the communities would go their separate ways. This means they would have to deal with issues on their own and there would be less representation at the national level. With no guidance, churches and political parties would now play larger roles in community development and could cause division with their different opinions. Areas such as natural resource management and promoting culture would fall to the wayside and greed and selfishness could become the new norm. There would be few opportunities developed for people, especially women, and this would increase the migration rate to Brazil and to the mining areas. Without an NRDDDB there would not be a Radio Paiwomak (the local radio station which serves many of the 16 local communities) for centralised communication, there would not be Bina Hill Institute (local training centre) and there would be little support for the local secondary school. The threats from big companies coming in and setting up operations without consultations would increase and so would conflicts between communities who may support such ventures. In other words there would be division and conflict among the communities.</p> <p><u>Scenario B - Blackmail, Corruption and Bribery</u> What would happen if the NRDDDB became more associated with a political party? It would lead to “Blackmail, Bribery and Corruption”. While there may be positives from having such an association, such as more money and more employment, the negatives would mean more alcohol in communities, the rise of prostitution and increases in trafficking of persons. While there would be support in time of crises, communities may fight more among themselves, as those who support a particular (ruling) party may benefit more. This would mean that those communities may become more financially developed. To become more political would mean that the NRDDDB would become less self-ruling, and there would be less transparency in decision making and in the allocation of jobs. There would be more of a leaning towards bribery as community leaders would be pressured into following the desires of their party. There would be an increase in crimes and favouritism within the NRDDDB. There would also be weak leadership both at the Board and community level. As this happens, the results would be over-harvesting of natural resources for short term gain, social values would continue to break down and there would be less safe guards. Large companies would move in as state lands are allocated to Brazilians and the Chinese on a larger scale. This would lead to pollution and changes in the wetland ecosystem from these operations. With the influx of money, peoples’ diet would change as they would have little time to farm.</p> <p><u>Scenario C - Self-sufficiency of the NRDDDB</u> NRDDDB is self-sufficient! This scenario explores the NRDDDB becoming a self-sufficient entity in 2030. The NRDDDB would now have the financial security to retain technically trained staff to carry out their work especially providing opportunities for the young people of the North Rupununi. Being self-sufficient, the NRDDDB would provide more representation and have a stronger negotiating position. They could promote and support a number of activities for communities, such as helping small businesses to develop, securing markets for North Rupununi made products, especially in Lethem and Brazil, and they would be able to self-promote North Rupununi tourism. Without dependency, the NRDDDB could help to provide more safe guards for community resources. There would be more enforcement of rules as a biodiversity monitoring system would be in place. There would also be a more efficient way to deal with emergency situations. A more capable NRDDDB would promote gender equity at the Board and community level. There would be more opportunities for women and the promotion of traditional practices both in public and private traditional based institutions. This may bring some conflict with the churches for promoting traditional beliefs. A self-sufficient NRDDDB would be a model for Guyana and the world.</p>
Men	<p><u>If oil was discovered and developed in the North Rupununi, what would the communities do?</u> From a social stand point, it was believed that there would perhaps be less unity among communities and an increase in greed. In addition, with more money circulating there would be more alcohol, increase in drugs and prostitution. Who would get the jobs? Would training be provided for local persons? Would the administration of the operations be manned only by outsiders? For the technological aspects, there would be both positives and negatives. Communication would improve and there would be regular electricity but with this would come changes in local lifestyle and culture. Depending on the technology used in the refining process, there could be pollution and waste products to be disposed. This would have an impact on the ecology of the wetlands and contribute more to climate change. On the economic side, it would mean more money in and around the North Rupununi. There would be a reduction in fuel costs but the prices for food would increase with less people farming and higher demand in shops.</p> <p>With oil development, benefits from the LCDS would reduce and communities may lose negotiation power as the District would no longer be operating on a green economy platform. From the political side, what would the negotiation and agreement between the company, Government and the communities be like? Would the communities through the NRDDDB be invited to the negotiating table? Would the process be fair and transparent or would there be bribery and avoidance of free, prior and informed consent? With the finding and development of oil, values would be affected. There would be changes to the community way of life. There would be improvements in infrastructure, but villagers may continue to lose their language and other cultural practices, the communal way of life would go, the way people dress would change, respect for elders could change, religion would have more influence on people, the rights to land and resources both human and natural maybe affected as there is more development.</p> <p>To counter act these changes and answer some of the questions, communities would need to become more familiar with the laws governing oil exploration and development in Guyana. From an NRDDDB level, all communities should come to a level of agreement for better negotiating power. There should be an environmental impact assessment done that would help to answer community concerns. Communities should agree to a benefit sharing agreement that would be proposed to the Government and the company and discuss any other assistance the communities would like. There should be shared governance and transparency; locals should be involved in the whole process so that there is a sense of ownership of the venture. The technology used in the operations should be low impact.</p>

Table 8 (Continued)

Group	Scenarios
Youth	<p><u>Scenario A - Having a recreation facility and it functioning well</u> In this scenario, the youths are successful and were able to build their recreational facilities. With the recreational centres in place, the youths would be happy, they would become more involved in other activities and there would be better representation in community activities. As a consequence, youths would be more disciplined and involved in activities that generate income. Youths would be encouraged to develop their athletic skills and could represent the North Rupununi at sporting tournaments at national and international levels. Having exercise equipment would promote more active and healthy youths and elders.</p> <p><u>Scenario B - Not having a recreation facility</u> The second potential future scenario is that there is little interest in the needs and desires of the youths. Their proposals are not accepted and funding is not obtained to build the recreational facilities. This would result in youths getting involved in criminal activities such as stealing, drugs, guns and rape; human trafficking would perhaps increase, there may be sex abuse and increases in teenage pregnancies. More youths may migrate to Brazil and the mining areas. In general, their lives may stay the same or become worse.</p> <p><u>Scenario C - Having a recreation facility and it failing</u> The third potential future would be that there would be enough interest to find funding for the recreational facilities. However, as progress is made, interest is lost by the key players. There is poor management, poor governance and lack of communication. This would result in the facilities not functioning properly and money and time would have been wasted.</p>

shares benefits poorly in this scenario. As for the regional level, corruption and participative democracy are not taken into account. Using other criteria, the scenario that could match this lose-lose pathway would be the “Once Green Hell” Scenario, in which social and environmental policies are poor, the dominant stakeholder is the private sector and the dominant scale is national.

There is also a lose-lose pathway from the regional to the global scale. This pathway involves a poor approach to markets (not integrating sustainability and poorly diversified), a poor integration of public policies (of scales and focus areas), low aid and a low approach to innovation. In essence, lose-lose scenarios from regional to global scales involve very poor cooperation across borders, between focus areas (e.g. environment, society, economy). It involves the “Security First”

scenario at the global level, as well as the “Inching along the precipice” and the “Once Green Hell” scenarios at regional level.

4. Discussion

Our main aim in linking scenarios across scales was to evaluate to what extent different viewpoints at multiple levels of governance converged (Biggs et al., 2007), and the subsequent implications for effective and equitable management of social-ecological systems. More specifically, we wanted to assess how visions of the future may impact local communities of the Guiana Shield and what their own perspectives could bring to higher scales of decision-making. Here, we

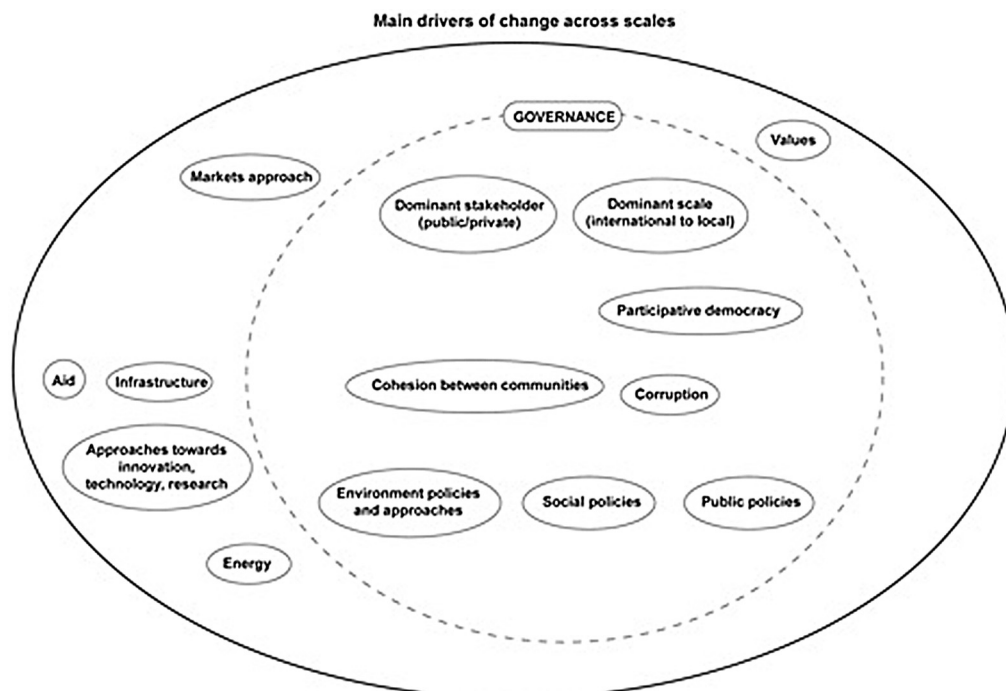


Fig. 3 – Map of the drivers classified into themes.

Table 9 – Overarching themes and their focus at the different scales (x represents a theme not mentioned at this scale).

	Local	National	Regional	Global	
Values	Values	Values	x	Values	
Participative Democracy	Leadership, autonomy, voice of youth, rule enforcement, political awareness	Accountability, stability	x	Participation	
Corruption	Level of corruption and transparency	Elitism, favouritism, criminality	x	The level of corruption in economy pushes people to work in formal or informal economy	
Public policies	x	x	Integration of policies at Amazon scale, rule enforcement	Integration of “focus areas” (e.g., environment, society, economy, technology)	
Social policies	Opportunities for all groups, also women and young people	Education (capacity building, training, jobs)	Include society in development of the Amazon or not, respect of local societies	Cultural integration, demography	
Environmental policies	Safeguarding of natural resources, protection from pollution (power from national scale)	Safeguarding of extraction, planning, focus on environment, interest for PES, land use	Planning, safeguard, pro/re-active approaches, land use, PES, green business, focus on environment or not	Views of the environment: profit, conservation, benefit sharing	
Cohesion with other communities	Networks and cohesion	x	x	x	
Dominant stakeholders	Public/private/community	Government/private	Public/private dichotomy, focus on investment	Public/private, government intervention in economy	
Dominant scale	Inclusion of community in decision	x	Regional focus	International focus	
Markets approach	x	Focus on export		Market approaches are inevitable	Open trade or closed, specialisation vs. diversification
Investment in infrastructure	x	Focus on road	x	x	
Approach to innovation	x		Prioritisation and investment uptake	Information, intellectual property, who's leading the innovation	Private vs. public leaders of innovation, who's promoting and benefitting from the innovation
Energy	x	Renewable technology, who's leading	x	Who's leading the decisions in terms of energy	
Aid	x	x	x	General nature and level of official development assistance	

discuss three key insights from the results. Firstly, the considerable mismatch between the different scales of analysis, especially between the local and global scales, and the role of the national level as the intermediary scale. Secondly, the importance of ‘values’ for determining future higher scale objectives. And third, the need to include diverse groups from within communities in scenario building and analysis.

4.1. Cross-scalar mismatch

At the global and regional scales, we see a strong focus on policies influencing society and the environment, with public-private partnerships as key facilitators. The GEO4 Scenarios, for example, play out the situation between economic development and the environment, and government and

Table 10 – Typology of cross-scalar scenarios.

Class	Description
1. Worse-case scenarios from local to national scales	This class links local and national scenarios through individualism, low participative democracy, high corruption, poor social and environmental policies and low benefit sharing. At the local level, these scenarios lead to conflict and divide, blackmail, and corruption. At the national scale, there is no continuity in the government and its policies, and very poor transparency.
2. The youth in the North Rupununi	This class represents the North Rupununi youth's scenarios. It shows that the youth's aspirations (to have voice and opportunities), could be reached through effective participative democracy and inclusive social policies.
3. Best-case scenarios from local to national scales	In this class, low corruption and good participative democracy bring together best-case scenarios at the local and national levels. Scenarios emphasise self-sufficiency, effective environmental management, equity and benefit sharing transparency in Guyanese politics.
4. Best-case scenarios from national to regional scales	In this class, national and regional scenarios find synergies on the themes of good social policies, good environmental policies, even balance of power between stakeholders and scales (but with the government slightly dominating), dynamic approach to innovation and high investment in infrastructure.
5. Sustainability first at global scale	This class is dominated by the Sustainability First global scenario, characterised by a market approach, innovation and energy issues.
6. Low collaboration between regional and global scales	This class is characterised by low collaboration and integration between countries, between scales, between policies, between peoples. It mainly concerns one global level scenario (Security First) and two regional level scenarios (A Once Green Hell, Inching Along the Precipice).
7. 'Intermediate' scenarios at global level	This class is constituted by the global level scenarios of "Policy First" and "Markets First", 'intermediate' scenarios belonging to neither best- or worst-case scenarios.

discussions acknowledge, and civil society organisations advocate, the important role of local and indigenous people in natural resource management (e.g. Cox et al., 2010; Blom et al., 2010), none of the higher scale scenarios feature local communities as dominant stakeholders in future environmental management. This mismatch is particularly significant considering local communities are most likely to play a key role as 'stewards' of resources in PES schemes, particularly in the process of monitoring the quality of ecosystem services in order to justify payments (Palmer-Fry, 2011; Danielsen et al., 2013).

In the few cross-scalar win-win situations identified by our analysis, local and national scale outcomes are linked by good governance structures and processes, highlighting the influence of effective and equitable power structures at national level on local level sustainable futures. This leads us to reason that the national scale is a key mediator between the local and regional/global scales, as can be seen in the case of REDD+ processes and implementation described above. This is reiterated by de Oliveira et al. (2013), who point out that in relation to national REDD+ agencies, the concerns are less about gaps in institutional or technical capacity, and more about gaps in legitimacy and governance principles such as transparency, quality control assurance, and fiduciary accountability. On this front the outlook is not optimistic. Although we see some positive trends in Guiana Shield governance at country level, such as the rule of law, other areas including effective regulatory control, transparency and corruption (the focus of national and local scenarios) show either little change or an actual worsening over the last fifteen years (World Bank, 2012).

At the same time, almost all the Guiana Shield countries have a high and growing dependency on natural resource extractive industries, such as mining, and logging, which are dominated by the private sector and are regularly linked to

malpractice and corruption (e.g. FPP, 2007; FPP, 2013; Hammond et al., 2007). This suggests major conflicts between conservation and large-scale resource extraction in the future. The seeds of these impending tensions are exemplified by the current high demand for minerals in the Guiana Shield, particular gold and bauxite (Berardi et al., 2013b), and the exploratory drilling for petroleum both offshore and inland in Guyana (Jafferally et al., 2012). It therefore comes as no surprise that the presence of resource mining, especially oil extraction, featured significantly in the national scenarios.

4.2. From short-term 'proximate' drivers to values-based 'ultimate' drivers

So in order to promote the development of win-win scenarios, what should politicians and practitioners focus on? Raskin et al. (2002) point out that mainstream environment/development policies focus almost exclusively on 'proximate' drivers; those that are responsive to short-term intervention, and include population size and growth, economic volume and patterns, technological choice, governance (with a focus on policies) and environmental quality. These proximate drivers are clearly reflected in the global, regional, and to a certain extent, national scenarios. However, our cross-scalar analyses show that there are other themes that can provide strong positive threads linking scales: values, participative democracy, social policies, environmental policies and dominant stakeholders. Values, in particular, are 'ultimate' drivers, or the root causes that shape society and the human experience (Raskin et al., 1998). In contrast to other scales, it is at the local level where we see 'values', subject to gradual cultural and political processes, as a clear and explicitly articulated determinant of futures, intimately connected to sustainable natural resource management (Pretty and Ward, 2001; Pretty and Smith, 2004).

We would therefore argue that there needs to be pathways for the ‘trickling up’ and reinforcement of community values through the development of participatory processes in policy development and implementation. Although values remain strong at the local level, they are threatened by top-down decisions made at the national level. Indeed, looking at the North Rupununi men’s scenarios around the discovery of oil, they show that local values and practices could radically change according to how the national government manages its extractive activities in the area. Values are also at the core of the North Rupununi women’s scenarios where the breakdown of community ethics and principles lead not only to social fragmentation and disintegration, but also concomitant environmental degradation and pollution. And, as illustrated by the scenarios developed by young people of the North Rupununi, if the link to understanding and proactively engaging with ultimate drivers is severed, there is a danger that youth will not contest the ‘structural’ issues determining the community/regional/national/international destiny, and therefore will not be active players, but passive pawns. This is particularly pertinent for local participation and potential ownership of PES and other related schemes. If current and future generations move away from their land centred worldview and environmental identity as ‘forest stewards’ towards more Western nature detached lifestyles, indigenous peoples may no longer have the capacity to play the ‘nature guardian’ role assumed within current policy paradigms (Mistry et al., 2013c).

4.3. Participation in scenario development

Van Vuuren et al. (2012) in their assessment of global environmental scenarios point out that although most scenario processes are highly participatory and rigorous in nature, there needs to be greater involvement from a broader range of ‘expertise’ that includes psychology, sociology and anthropology. We would go further to suggest that scenario development does not need to be confined to the domain of ‘experts’ or ‘futurists’ at all. Involving a range of relevant stakeholders in a participatory process provides an opportunity for different worldviews to be conveyed and discussed (e.g. Bohunovsky et al., 2011; Kaltenborn et al., 2012), thereby allowing different interests and perspectives to be shared for mutual and collective learning within social networks (Reed et al., 2010). It also allows for better use of scenarios as a research tool to elicit data on multi-scalar synergies and conflicts.

For local community members in the North Rupununi, taking part in a scenario process provided them with improved thinking about futures and understanding potential processes of change and adaptation (Ravera et al., 2011):

“I think workshops like this works well when there is gender balance; where you see the interconnection of one another’s vision as from the group discussions of the women, men, and youth. When you look at most of the presentations you see from each perspective there were the same kinds of vision and information coming out; if it was not about oil, it was recreational issues or the future of the NRDDB. I think that the men and women should come

together at the same level to help work things out” (youth participant, quoted in Jafferally et al., 2012).

This quote also reflects the importance of dividing participants into interest groups (both in the national level and local scenario workshops), so as to allow people to more freely voice their uncertainties and aspirations for the future (Berkes, 2009; Johnson et al., 2012). This was particularly important at the local level where women and youth, normally the most marginalised members of the community, were given a more equal footing to express a diverse range of worldviews as reflected in their scenarios (Rawluk and Godber, 2011). And although not a goal of the scenario process, many of the local participants found the techniques and results potentially useful for planning their community’s future activities: “This was interesting for me working with the men’s group. The work that we have done was like an assessment of some of our development and what has been going on now and could in the future. We can use some of these tools in our communities. I find these tools adaptive. In our area oil is being looked for. What would happen if oil is found in the next year or thirty years from now? Where would our communities be? Would we have a good negotiating position? I have learnt a lot from the three groups that presented today. I would like to thank the staff for giving these tools to us and I will impart this knowledge to my community” (older male participant, quoted in Jafferally et al., 2012).

5. Conclusion

Our analysis of international, regional, national and local scenario sets is novel in that it has provided insights that are relevant to decisions being made today on environmental management in the Guiana Shield and beyond. We see the juxtaposition between national and higher scales focus on schemes such as PES and REDD+ as potential pathways to a ‘green economy’ and the lack of this vision in any of the local communities’ scenarios. We also see that local communities as key stakeholders and the potential of grassroots movements to make significant changes, do not feature in any of the scenarios except those created at the local scale. This is in light of the fact that the Guiana Shield and wider Latin America has a long history of grassroots movements (e.g. Collinson, 1996; Martinez-Alier, 2013; Shapiro, 2013) and the recent worldwide phenomena of public protests and uprisings, such as the Zapatista Uprising, the Occupy Movement and the Arab Spring. Good governance is cited as a prerequisite for any form of effective cross-scalar social-ecological management, yet past trends and the current political situation in the Guiana Shield does not provide optimism for positive future outcomes which take into account the current contexts and future aspirations of local communities.

Undoubtedly, the Amazon and Guiana Shield have high political and environmental relevance to the global community (Pokorny et al., 2013), particularly in terms of carbon storage, hydrology and biodiversity, and there are various trans-boundary initiatives to conserve the region as a whole, such as the Guiana Shield Facility (GSF) (see www.guianashield.org),

a multi-donor funding facility supporting regional institutional, administrative and policy frameworks for natural resource management. Yet, our scenario analysis indicates that future trajectories for the Guiana Shield as a region are very different to the visions of national stakeholders and local communities, with potentially important implications for the cohesion of the region in terms of social–ecological policy integration.

Integral to any success with environmental management aspirations driven by international and national policy developments will be giving local communities representative and ownership powers over how these policies are constructed and eventually implemented on the ground at community level. Within Project COBRA we have seen how tokenistic attempts at community consultation and participation have repeatedly failed because the modes of communication (usually dominated by written texts and complex vocabulary) simply do not allow community members to effectively participate. It is not surprising that most parties come away unsatisfied by these community engagement processes. Project COBRA, on the other hand, has promoted the use of visual forms of communication, including videos and photostories, for the active and effective engagement of community participants (Berardi et al., 2013a; Mistry et al., 2013b,c).

Another significant difference between the professional futurists' and a communities' approach to visioning the future was the difference between a preference for disciplinary abstraction and holistic practicalities, respectively. An important aspect to the implementation of scenario processes is the direct and explicit connection between scenario exercises and concrete decision-making. In fact, some scenario workshop participants, especially those drawn from non-academic sectors, wanted to take the 'inside-out' perspective, rather than the 'outside-in' perspective (Ogilvy, 2011). In other words, they had a more action-oriented way of approaching the scenario process, thinking more about the end point and what they can do to their world, rather than a more academic preference for detailed discussion over action. Johnson et al. (2012) point out that whereas scenarios employ open-ended, creative systems thinking, policy discussions and institutional decision-making tends to focus on individual issues or specific near-term problems, which can make linking the two types of processes challenging. In respect to this point, Ogilvy (2011) suggests that participant ownership over scenarios can come about through the development of lists of early indicators for each scenario; as participants try to imagine the first signs of a scenario, they inevitably find themselves occupying the world described by that scenario. This may be a way of motivating communities and others to incorporate visioning processes within their decision-making.

Linking participant qualitative narrative indicators to quantitative modelling could also be another approach. The IPCC scenarios, for example, provide both narratives as well as elaborate quantitative analyses. Scenarios by Costanza (2000) and the Very Long Range Scenarios in the Millennium Project are merely storylines without modelling exercise. Swart et al. (2004) states that as complexity increases and the time horizon of interest lengthens, the power of prediction diminishes. Therefore, "quantitative forecasting is legitimate to the degree the state of the system under consideration can be specified, the dynamics governing change are understood and known to

be persistent, and mathematical algorithms can be created that map these relationships with sufficient accuracy for simulation" (p.140). Quantification of storylines is mostly done in global and regional scenarios, but developing measurable indicators and modelling different drivers of change at national and local levels could also yield useful information for social-ecological system management. In our case, the cross-scalar scenario exercise was primarily an exploration of scientific understanding of the dynamics that may shape the future of the Guiana Shield and its local communities. Future iterative interactions between the qualitative scenario data and quantitative scientific information from the region could stimulate greater cross-pollination of knowledge types that might generate useful insights for sustainable management of the region.

This paper therefore calls for an approach for devising future scenarios which is participatory, visual and qualitative, and in which stakeholder values are explicitly articulated. Only once policy makers at higher levels of decision-making, from national governments to international meetings and conventions, take on board this approach, will we see greater compatibilities between the aspirations and actions of communities on the ground, and policy development at other scales, especially with regards to the emerging significant mobilisation of finance in tackling climate change and adaptation. We acknowledge that the upfront costs of community engagement in visioning futures may seem prohibitive, but through this process of engagement, not only are communities preparing for 'living the future' in advance, but they are also helping to challenge mindsets, raise awareness and stimulate discussion and creative thinking amongst decision-makers who are often accused of having fixed and issue specific obsessions, have limited awareness of local issues, and lack creative solutions for emerging wicked challenges.

Acknowledgements

We would like to thank all the participants of the North Rupununi and Guyana scenario workshops and Dominique Laffly for his advice in carrying out statistical analysis. Thank you to the anonymous reviewers for their comments. This research has been funded by the Environment Programme, Management of Natural Resources, DG Research and Innovation, European Commission 7th Framework.

Appendix A. Appendix A

The Global Environment Outlook, GEO4 scenarios (adapted from <http://www.unep.org/geo/GEO4.asp>).

Markets First- This scenario pays lip service to sustainable development in terms of the ideals of the Brundtland Commission, Agenda 21 and other major policy decisions. There is a narrow focus on the sustainability of markets rather than in the context of the broader human-environment system.

Policy First - This scenario introduces some measures aimed at promoting sustainable development, but the

tensions between environment and economic policies are biased towards social and economic considerations.

Security First - This scenario focuses on the interests of a minority: rich, national and regional. It emphasizes sustainable development only in the context of maximizing access to and use of the environment by the powerful.

Sustainability First - This scenario gives equal weight to environmental and socio-economic policies, accountability, and it stresses transparency and legitimacy across all actors. It emphasizes the development of effective public-private sector partnerships not only in the context of projects but in the area of governance, ensuring that stakeholders across the environment-development discourse spectrum provide strategic input to policy making and implementation.

The Global Environment Outlook, GEO Amazonia scenarios (adapted from UNEP & ACTO, 2009).

Emergent Amazonia - This scenario assumes that public policies aim at improving social services and promote sustainable development based on effective environmental governance. The State has managed to reduce poverty and inequality of income distribution. Market forces provide incentives for developing sustainable productive activities, in such a way that the stability of the ecosystems is guaranteed and ecosystem goods and services are valued. However, science, technology and innovation have limited development.

Inching along the Precipice - This scenario assumes that Amazonian population growth increases. Amazonia has become very attractive for multi-national investors and contributes to alleviate the food crisis caused by drought due to climate change in traditional cereal and grain producing areas.

Although public policies promote sustainable development, market forces provide incentive for developing unsustainable productive activities that affect ecosystem stability and place no value on environmental goods and services. Science, technology and innovation have limited development.

Light and Shadow - This scenario assumes that demographic growth in the Amazonian countries stabilises. There is an increase in innovative initiatives that take advantage of investment opportunities to promote social-environmental sustainability, but initiatives for the valorisation of ecosystem services and internalization of environmental costs in production have not been very successful. There is investment in science, technology and innovation which promotes the development needed to optimise the sustainable utilisation of resources.

The Once-Green Hell - This scenario assumes that the Amazonian part of each country is the area that has registered the largest demographic growth. Public policies fail to promote sustainable development; the environmental component is missing from the public decision making process. Furthermore, market forces provide incentives for developing unsustainable productive activities. Science, technology and innovation have limited development.

REFERENCES

- Berardi, A., Mistry, J., Tschirhart, C., Abraham, J., Bignante, E., 2012. Report on the cross-scalar interactions and compatibilities governing sustainable development and ecosystem service management of the Guiana Shield. Available from: <http://projectcobra.org/wpcontent/uploads/D2.1Reportoncross-scalarinteractionsandcompatibilities3.pdf> [accessed 5 December 2013]
- Berardi, A., Tschirhart, C., Mistry, J., Bignante, E., Haynes, L., Albert, G., Benjamin, R., Xavier, R., Jafferally, D., 2013a. From resilience to viability: a case study of indigenous communities of the North Rupununi, Guyana. *EchoGéo* 24, <http://dx.doi.org/10.4000/echogeo.13411> [online].
- Berardi, A., Mistry, J., Tschirhart, C., Verwer, C., Glastra, R., de Ville, G., Davis, O., de Souza, C., Haynes, L., Benjamin, R., Xavier, R., Albert, G., Jafferally, D., Bignante, E., Abraham, J., 2013b. Second Report on the cross-scalar interactions and compatibilities governing sustainable development and ecosystem service management of the Guiana Shield: drivers of social and environmental degradation, and policy responses. Available from: <http://projectcobra.org/wpcontent/uploads/D2.1Reportoncross-scalarinteractionsandcompatibilities3.pdf> [accessed 15 January 2014]
- Berkes, F., 2009. *Evolution of co-management: role of knowledge generation, bridging organizations and social learning*. *J. Environ. Manage.* 90, 1692–1702.
- Berkes, F., Folke, C., 1998. *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*. Cambridge University Press, Cambridge.
- Berkes, F., Colding, J., Folke, C. (Eds.), 2003. *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Cambridge University Press, Cambridge.
- Berkhout, F., Hertin, J., Jordan, A., 2002. Socio-economic futures in climate change impact assessment: using scenarios as 'learning machines'. *Global Environ. Change* 12, 83–95.
- Biggs, R., Raudsepp-Hearne, C., Atkinson-Palombo, C., Bohensky, E., Boyd, E., Cundill, G., Fox, H., Ingram, S., Kok, K., Spehar, S., Tengö, M., Timmer, D., Zurek, M., 2007. *Linking futures across scales: a dialog on multiscale scenarios*. *Ecol. Soc.* 12 (1) 17 <http://www.ecologyandsociety.org/vol12/iss1/art17/>
- Bignante E. (2010). The use of photo elicitation in field research: Exploring Maasai representation and use of natural resources, *EchoGéo*, 11, [Online], URL: <http://echogeo.revues.org/index11622.html>.
- Blom, B., Sunderland, T., Murdiyarto, D., 2010. *Getting REDD to work locally: lessons learned from integrated conservation and development projects*. *Environ. Sci. Policy* 13 (2) 164–172.
- Bohensky, E., Butler, J.R.A., Costanza, R., Bohnet, I., Delisle, A., Fabricius, K., Gooch, M., Kubiszewski, I., Lukacs, G., Pert, P., Wolanski, E., 2011. *Future makers or future takers? A scenario analysis of climate change and the Great Barrier Reef*. *Global Environ. Change* 21, 876–893.
- Bohunovsky, L., Jäger, J., Omann, I., 2011. *Participatory scenario development for integrated sustainability assessment*. *Reg. Environ. Change* 11, 271–284.
- Borges, J.R. (2010). *Payments for Environmental Services: Financing Community Development and Conservation*. Paper presented at Climate Change & Mitigation in Agriculture in Latin America & the Caribbean: Investments & Actions, 19–20 April 2010, FAO, Rome. Available from: http://www.fao.org/fileadmin/templates/tci/pdf/backgroundnotes/Borges_PES_-_Financing_Community_Development_and_Conservation_.pdf [accessed 15 December 2013].
- Bovolo, C.I., Parkin, G., Wagner, T., 2009. *Initial Assessment of the Climate of Guyana and the Region with a Focus on Iwokrama*. School of Civil Engineering & Geosciences, Newcastle University, Newcastle upon Tyne, UK.

- Brown, V.A., Harris, J.A., Russell, J.Y. (Eds.), 2010. *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*. Earthscan, London, England.
- Charmaz, K., 2006. *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*. Sage, London.
- Colchester, M. and La Rose, J. (2010). Our land, our future: promoting indigenous participation and rights in mining, climate change and other natural resource decision-making in Guyana. Amerindian Peoples Association, Guyana, Forest Peoples Programme, UK and The North-South Institute, Canada.
- Colchester, M., MacKay, F., Griffiths, T. and Nelson, J. (2001). A survey of indigenous land tenure: a report for the land tenure service of the Food and Agriculture Organisation. Forest Peoples Programme, Moreton-in-Marsh, UK.
- Collinson, H. (Ed.), 1996. *Green Guerrillas: Environmental Conflicts and Initiatives in Latin America and the Caribbean*. Latin American Bureau, London.
- Corbera, E., Schroeder, H., 2011. *Governing and implementing REDD+*. *Environ. Sci. Policy* 14 (2) 89–99.
- Costanza, R., 2000. Visions of alternative (unpredictable) futures and their use in policy analysis. *Conserv. Ecol.* 4 (1) 5.
- Cox, M., Arnold, G., Villamayor Tomás, S., 2010. A review of design principles for community-based natural resource management. *Ecol. Soc.* 15 (4) 38.
- Danielsen, F., Adrian, T., Brofeldt, S., van Noordwijk, M., Poulsen, M.K., Rahayu, E., Rutishauser, I., Theilade, A., Widayati, N., The, A., Nguyen Bang, T., Budiman, A., Enghoff, M., Jensen, A.E., Kurniawan, Y., Li, Q., Mingxu, Z., Schmidt-Vogt, D., Prix, S., Thoutone, V., Warta, Z., Burgess, N., 2013. *Community monitoring for REDD+: international promises and field realities*. *Ecol. Soc.* 18 (3) 41.
- Dávalos, L.M., Bejarano, A.C., Hall, M.A., Correa, H.L., Corthals, A.P., Espejo, O.J., 2011. *Forests and drugs: coca-driven deforestation in global biodiversity hotspots*. *Environ. Sci. Technol.* 45 (4) 1219–1227.
- Davis, O., Bovolo, I., Jafferally, D., Mistry, J. and Glastra, R. (2012). Guyana in 2030: developing alternative future scenarios through Georgetown stakeholder participation. Available from: <http://projectcobra.org/guyana-in-2030> [accessed 15 December 2013].
- de Oliveira, J.P., Cadman, T., Ma, H.O., Maraseni, T., Koli, A., Jadhav, Y.D. and Prabowo, D. (2013). *Governing the forests: an institutional analysis of REDD+ and community forest management in Asia*. International Tropical Timber Organization (ITTO) and the United Nations University Institute of Advanced Studies (UNU-IAS), Japan.
- Economic of Climate Adaptation (ECA), 2009. *Shaping climate-resilient development - a framework for decision-making*. A report of the economics of climate adaptation working group. ClimateWorks Foundation, Global Environment Facility, European Commission, McKinsey & Company, The Rockefeller Foundation, Standard Chartered Bank and Swiss Re. Available from: http://ec.europa.eu/development/icenter/repository/ECA_Shaping_Climate_Resilient_Development.pdf [accessed 15 January 2013].
- Economic Commission for Latin America and the Caribbean (ECLAC), 2011. *An assessment of the economic impact of climate change on the agriculture sector in Guyana*. Economic Commission for Latin America and the Caribbean. Available from: http://www.eclac.org/portofspain/noticias/paginas/0/44160/Guyana_ICAR1323.pdf [accessed 15 January 2013].
- Enfors, E.I., Gordon, L.J., Peterson, G.D., Bossio, D., 2008. Making investments in dryland development: participatory scenario planning in the Makanya Catchment, Tanzania. *Ecol. Soc.* 13 (2) 42 <http://www.ecologyandsociety.org/vol13/iss2/art42/>
- Evans, L.S., Hicks, C.C., Fidelman, P., Tobin, R.C., Perry, A.L., 2013. *Future scenarios as a research tool: investigating climate change impacts, adaptation options and outcomes for the Great Barrier Reef*. Australia. *Human Ecol.* 41, 841–857.
- Forest Carbon Partnership Facility, 2013. REDD+ country participants. Available from: <http://www.forestcarbonpartnership.org/redd-country-participants> [accessed 15 December 2013].
- Forest People Programme, 2007. Free, Prior and Informed Consent: Two Cases from Suriname. Available from: <http://www.forestpeoples.org/sites/fpp/files/publication/2010/08/fpicsurinamemar07eng.pdf> [accessed 15 December 2013].
- Forest People Programme, 2013. Indigenous peoples' rights violated and traditional lands in Guyana threatened by mining. Available from: <http://www.forestpeoples.org/topics/extractive-industries/news/2013/02/indigenous-peoples-rights-violated-and-traditional-lands-g> [accessed 15th December 2013].
- Goeminne, G., Mutombo, E., 2007. The Field of Scenarios: fuzziness as a chance for building appealing future visions, working paper for the CONSENTSUS project. CDO-UGent/ CEDD-ULB, Gent/Brussel (Work Package 2). Available from: http://www.belspo.be/belspo/ssd/science/Reports/A3_Goeminne_Mutombo_The%20field%20of%20scenarios_WP2_CDO_ULB.pdf [accessed 11 June 2012].
- Goodwin, P., Wright, G., 2009. *Decision analysis for management judgment*, 4th Edition. John Wiley & Sons, London.
- Groves, D.G., Lempert, R.J., 2007. *A new analytic method for finding policy-relevant scenarios*. *Global Environ. Change* 17 (1) 73–85.
- Gunderson, L., Holling, C.S. (Eds.), 2002. *Panarchy: understanding transformations in human and natural systems*. Island Press, Washington, D.C..
- Hall, G., Patrinos, H.A., 2005. *Indigenous Peoples, Poverty and Human Development in Latin America 1994–2004*. World Bank, Washington DC.
- Hall, G., Patrinos, H.A., 2010. *Indigenous Peoples, Poverty and Development*. World Bank, Washington DC http://siteresources.worldbank.org/EXTINDPEOPLE/Resources/407801-1271860301656/full_report.pdf.
- Hammond, D.S. (Ed.), 2005. *Tropical Forests of the Guiana Shield: Ancient Forests in a Modern World*. CABI Publishing, Cambridge, Massachusetts.
- Hammond, D.S., Gond, V., de Thoisy, B., Forget, P.M., DeDijn, B.P.E., 2007. *Causes and consequences of a tropical forest gold rush in the Guiana Shield*. *South America. Ambio* 36, 661–670.
- Hulse, D.W., Branscomb, A., Payne, S.G., 2004. *Envisioning alternatives: using citizen guidance to map future land and water use*. *Ecol. Appl.* 14, 325–341.
- Jafferally, D., Mistry, J., Glastra, R., Bovolo, I., 2012. *North Rupununi in 2030: alternative future scenarios for the development of the North Rupununi*. COBRA Project. Available from: <http://projectcobra.org/north-rupununi-in-2030/> [accessed 15 December 2013].
- Johnson, K.A., Dana, G., Jordan, N.R., Draeger, K.J., Kapuscinski, A., Schmitt Olabisi, L.K., Reich, P.B., 2012. *Using participatory scenarios to stimulate social learning for collaborative sustainable development*. *Ecol. Soc.* 17 (2) 9.
- Kaltenborn, B.P., Thomassen, J., Linnell, J.D.C., 2012. *Island futures – does a participatory scenario process capture the common view of local residents?* *Futures* 44, 328–337.
- Kindon, S., Pain, R., Kesby, M., 2007. *Participatory Action Research Approaches and Methods: Connecting People, Participation and Place*. Routledge, London.
- Kok, K., Biggs, R., Zurek, M., 2007. *Methods for developing multiscale participatory scenarios: insights from Southern*

- African and Europe. *Ecol. Soc.* 13 (1) 8 <http://www.ecologyandsociety.org/vol12/iss1/art8/>
- Kok, K., van Vliet, M., Bärlund, I., Dubel, A., Sendzimir, J., 2011. Combining participative backcasting and exploratory scenario development: experiences from the SCENES project. *Technol. Forecast. Soc.* 78, 835–851.
- Lebart L., Morineau A., Piron M., 1997. *Statistique exploratoire multidimensionnelle*. Dunod, Paris.
- Ledec, G., Quintero, J.D., 2003. Good Dams and Bad Dams: Environmental Criteria for Site Selection of Hydroelectric Projects. Latin America and Caribbean Region Sustainable Development Working Paper 16. Washington DC, World Bank.
- Linstone, H.A., Turoff, M. (Eds.), 1975. *The Delphi Method: Techniques and Applications*. Addison-Wesley, USA.
- MA (Millennium Ecosystem Assessment), 2005. *Ecosystems and human well-being: synthesis*. Island Press, Washington, DC.
- Martin, A., Gross-Camp, N., Kebede, B., McGuire, S., Munyarukaza, J., 2013. Whose environmental justice? Exploring local and global perspectives in a payments for ecosystem services scheme in Rwanda. *Geoforum*, <http://dx.doi.org/10.1016/j.geoforum.2013.02.006>.
- Martinez-Alier, J., 2013. The environmentalism of the poor. *Geoforum*, <http://dx.doi.org/10.1111/tran.12010>.
- Maughan, M.J., 2011. Land Grab and Oil Palm in Colombia. Paper presented at the International Conference on Global Land Grabbing 6–8 April 2011. Organised by the Land Deals Politics Initiative (LDPI) in collaboration with the Journal of Peasant Studies and hosted by the Future Agricultures Consortium at the Institute of Development Studies, University of Sussex.
- McAfee, K., 2012. The contradictory logic of global ecosystem services markets. *Dev. Change* 43, 105–131.
- McSweeney, C., New, M., Lizcano, G., 2012. Guyana. UNDP Climate Change Country Profiles Available from: <http://www.geog.ox.ac.uk/research/climate/projects/undp-cp/index.html?country=Guyana&d1=Reports> [accessed 15 January 2013].
- Mistry, J., 2014. Natural resource management: a critical appraisal. In: Desai, V., Potter, R. (Eds.), *The Companion to Development Studies*. Routledge., Abingdon, UK (in press).
- Mistry, J., Berardi, A., 2012. The challenges and opportunities of using participatory video in geographical research: a case study exploring collaboration with indigenous communities of the North Rupununi. *Guyana. Area* 44 (1) 110–116.
- Mistry, J., Berardi, A., McGregor, D., 2009. Natural resource management and development discourses in the Caribbean: reflections on the Guyanese and Jamaican experience. *Third World Q.* 30 (5) 969–989.
- Mistry, J., Tschirhart, C., Berardi, A., 2013a. Report on best practice case studies. Available from: <http://projectcobra.org/wp-content/uploads/WP4-BestPracticesReport.pdf> [accessed 5 December 2013].
- Mistry, J., Verwer, C., Tschirhart, C., Glastra, R., Davis, O., Jafferally, D., Bovolo, I., 2013b. Report on the cross-scalar social-ecological scenarios of the Guiana Shield. Available from: <http://projectcobra.org/wp-content/uploads/WP3Report.pdf> [accessed 5 December 2013].
- Mistry, J., Berardi, A., Haynes, L., Davis, D., Xavier, R., Andries, J., 2013c. The role of social memory in natural resource management: insights from participatory video. *Transactions of the Institute of British Geographers*, early view online, <http://dx.doi.org/10.1111/tran.12010>.
- Murat Arsel, M., Büscher, B., 2012. Nature™ Inc.: changes and continuities in neoliberal conservation and market-based environmental policy. *Dev. Change* 43, 53–78.
- Nemarundwe, N., Jong, W.de., Cronkleton, P., 2003. *Future Scenarios as an Instrument for Forest Management: Manual for Training Facilitators of Future Scenarios*, Center for International Forestry Research (CIFOR), Bogor, Indonesia.
- Ogilvy, J.A., 2011. *Facing the fold. Essays on scenario planning*. Triarchy Press, Devon, UK.
- Okereke, C., Dooley, K., 2010. Principles of justice in proposals and policy approaches to avoided deforestation: towards a post-climate agreement. *Global Environ. Change* 20, 82–95.
- O'Toole, G., 2013. Sustainable living in South America: what influences consumer behaviour? *The Guardian*. Wednesday 13 February 2013. Available from: <http://www.guardian.co.uk/sustainable-business/sustainable-living-south-america-behaviour?intcmp=122&CMP> [accessed 15 February 2013].
- Palacios-Agundez, I., Casado-Arzuaga, I., Madariaga, I., Onaindia, M., 2013. The relevance of local participatory scenario planning for ecosystem management policies in the Basque Country, northern Spain. *Ecol. Soc.* 18 (3) 7.
- Palmer-Fry, B., 2011. Community forest monitoring in REDD+: the 'M' in MRV? *Environ. Sci. Policy* 14, 181–187.
- Patel, M., Kok, K., Rothman, D.S., 2007. Participatory scenario construction in land use analysis: an insight into the experiences created by stakeholder involvement in the Northern Mediterranean. *Land Use Policy* 24, 546–561.
- Pokorny, B., Scholz, I., de Jong, W., 2013. REDD+ for the poor or the poor for REDD+? About the limitations of environmental policies in the Amazon and the potential of achieving environmental goals through pro-poor policies. *Ecol. Soc.* 18 (2) 3.
- Pretty, J., Ward, H., 2001. Social capital and the environment. *World Dev.* 29 (2) 209–227.
- Pretty, J., Smith, D., 2004. Social capital in biodiversity conservation and management. *Conserv. Biol.* 18 (3) 631–638.
- Rainforest Alliance, 2012. Verification Of Progress Related To Indicators For The Guyana-Norway REDD+ Agreement. 2nd Verification audit covering the period October 1, 2010–June 30, 2012. Available from: <http://theredddesk.org/markets-standards/guyana-guyana-redd-investment-fund-and-norway-partnership> [accessed 15 December 2013].
- Ravera, F., Hubacek, K., Reed, M., Tarrasón, D., 2011. Learning from experiences in adaptive action research: a critical comparison of two case studies applying participatory scenario development and modelling approaches. *Environmental Policy and Governance* 21, 433–453.
- Raskin P., Gallopin, G., Gutman, P., Hammond, A., Swart, R., 1998. Bending the curve: towards global sustainability. Stockholm Environment Institute and Global Scenario Group, SEI PoleStar Series Report n. 8. Stockholm.
- Raskin P., Banuri, T., Gallopin, G., Gutman, P., Hammond, A., Kates, R., Swart, R., 2002. Great Transition, the Promise and Lure of the Times Ahead. Stockholm Environment Institute and Global Scenario Group, SEI PoleStar Series Report n. 10. Boston.
- Rawluk, A., Godber, A., 2011. Widening the scope of scenario planning in small communities: a case study use of an alternative method. *Ecol. Soc.* 16 (1) 11 <http://www.ecologyandsociety.org/vol16/iss1/art11/>
- Reason, P., Bradbury, H., 2008. *The Sage Handbook of Action Research: Participative Inquiry and Practice*. Sage, London.
- Reed, M.S., Evely, A.C., Cundill, G., Fazey, I., Glass, J., Laing, A., Newig, J., Parrish, B., Prell, C., Raymond, C., Stringer, L.C., 2010. What is social learning? *Ecol. Soc.* 15 (4) r1 <http://www.ecologyandsociety.org/vol15/iss4/resp1/>
- Rittel, H.W.J., Webber, M.M., 1973. Dilemmas in a General Theory of Planning. *Policy Sciences* 4, 155–169.
- Sanders L., 1989. L'analyse des données appliquée à la géographie. G.I.P. Reclus, Montpellier.
- Shapiro, E., 2013. Contesting market-based conservation: Payments for ecosystem services as a surface of engagement for rural social movements in Mexico. *Hugeog* 6 (1) 134–150.

- Soares-Filho, B.S., Nepstad, D.C., Curran, L.M., Cerqueira, G.C., Garcia, R.A., Ramos, C.A., Voll, E., McDonald, A., Lefebvre, P., Schlesinger, P., 2006. *Modelling conservation in the Amazon basin*. *Nature* 440, 520–523.
- Swart, R.J., Raskin, P., Robinson, J., 2004. *The problem of the future: sustainability science and scenario analysis*. *Global Environ. Change* 14, 137–146.
- Transparency International, 2013. *Corruption Perceptions Index 2013*. Available from: http://www.transparency.org/whatwedo/pub/cpi_2013 [accessed 31st December 2013].
- UNDP, 2012. *Human Development Index 2012*. Available from: <http://hdr.undp.org/en/data/profiles> [accessed 31st December 2013].
- UNEP, 2010. *Latin America and the Caribbean–Environment Outlook*. GEO LAC3. United Nations Environment Programme, Regional Office for Latin America and the Caribbean, Panama City, Panama.
- UNEP & ACTO, 2009. *Environment Outlook in Amazonia*. Published by the United Nations Environment Programme (UNEP) and the Amazon Cooperation Treaty Organization (ACTO) in collaboration with the Research Center of the Universidad del Pacífico (CIUP).
- Van Vuuren, D.P., Kok, M.T.J., Girod, B., Lucas, P.L., de Vries, B., 2012. *Scenarios in Global Environmental Assessments: key characteristics and lessons for future use*. *Global Environ. Change* 22, 884–895.
- Wollenberg, E., Edmunds, D. and Buck, L., 2000. *Anticipating change: scenarios as a tool for adaptive forest management: a guide*. Center for International Forestry Research (CIFOR), Bogor, Indonesia.
- World Bank, 2012. *Governance matters*. Available from: <http://data.worldbank.org/data-catalog/worldwide-governance-indicators> [accessed 31st December 2013].
- Zurek, M.B., Henrichs, T., 2007. *Linking scenarios across geographical scales in international environmental assessments*. *Technol. Forecast. Soc.* 74, 1282–1295.