

12 The aim is important, not the way you get there: A new model

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The issue

More often than not, decision makers pursue and desire to encounter and to apply a single ultimate solution for a complex issue. However, reality and even scientific theory teaches that there are no simple or single-track solutions for complex problems. Many of such complex problems are rather wicked and escape quick “fixes” (Rayner and Malone 1998). The targeted issue of more sustainable land-use management in the Amazon basin certainly belongs into this category. While simple solutions appear attractive, they may do more harm and damage than doing nothing. In this context such “solutions” can basically be categorized as futile actionism. We therefore propose a different approach in form of a conceptual model that integrates project experience with long-term experience by Embrapa and external expertise.

The Amazon biome is a highly complex meta-ecosystem, not even fully understood by science. Overprinting this biome and its functionality with any kind of post-forest land use increases complexity in close spatial proximity to the forest system. The various stages of biophysical immaturity of human-demand driven land cover develops its own dynamics. Obviously, small-scale slash-and-burn practices with rotating small-scale agriculture have little more disturbing effect than a natural forest opening, triggered by the loss of some large mature trees, e.g., felled by a tropical wind storm (photo below). Individual small-scale farming, independent of the type of plantation, is also likely to be of limited disturbance. Yet, collectively, many individual small-scale farms in close proximity to each other may rapidly magnify into a much larger-scale disturbance. In consequence, the biome becomes fragmented comparable to effects of large-scale industrial agriculture.



Forest opening at site 1220 near Nova California; Phase 02



Forest is the natural land cover for the Amazon biome. If humans with their current land-management practices retreated from the land, woodland would re-establish almost everywhere within years and decades. This re-establishment is not equal to a full recovery of the ecosystem, since the system would show its former disturbance for rather long time frames (centuries). Recognizing the relevance and importance of the Amazon biome for Brazil and beyond, and the doubtlessly detrimental effect of non-sustainable land use in the basin, it appears only consistent to think about ways out of this vicious cycle of a seemingly inescapable drive for more land grabbing for agriculture, agroforestry, for settlements and industry, mining and other forms of natural resource exploitation.

Today about 34 million people live in the Amazon basin. The population in Amazonas state reached 4.002 million in 2016 (IBGE 2016) with more than 2 million in the capital Manaus. Yet, this is a very recent growth. Manaus had less than 300.000 inhabitants in 1980 and villages and towns that had then a few hundred to a few thousand residents are today home to tens of thousands, e.g., places near our sampling and experimental locations such as Itacoatiara, Rio Preto da Eva, Apuí, Humaitá, Lábrea and Boca do Acre. Families established their lives and infrastructures were developed. At present, hospitals, schools and even satellite campuses of universities, power plants, shopping centers, small airports and typical modern amenities can be found almost everywhere – not only in the state capitals.



Where does the future lead us?

Two key issues that appear underexplored are connected to this development. People with ethnical roots in Amazônia are a minority today. Most people, even in more remote places, are immigrants from southern and north-eastern Brazil or from other countries. They are still newcomers, since that wave of modern settlement started in the second half of the 20th Century. Since immigrants came to develop the land and make a better life for themselves, a frontier spirit developed (similar to that in North America in the 19th Century) with clear emphasis on survival and economic success. Most of these people were not highly educated



and endured truly tough conditions before they or their offspring reached a certain economic affluence, which can now be observed in many places. This affluence, however, came with the price of land degradation and partly massive deforestation.

The people's urge and need to survive and to succeed was coupled with the rather reckless and in part still ongoing suppression of indigenous people (first nations) who today have much smaller population numbers and settlement sizes. With a few exceptions, the radically different indigenous life style has never been appreciated or even respected by most new immigrants. A perception of superiority over the "primitive" indigenous people further hampers until today any attempt to learn from their long-term experience on how to deal with the harsh natural boundary conditions in the Amazon.

In effect and to this day, the new immigrants apply land management techniques that they imported from their home places. They force these techniques onto a radically different natural environment that cannot deal with the related impacts. Agricultural land can deliver decent yields for a limited number of years only and is then exhausted, "forcing" the agriculturist and farmer to cut more forest for plantations or pastureland. The ever-growing population of immigrants propagates the need for more land with every generation, demands more and better infrastructures – driving a vicious cycle of biome disintegration and decay.

The evidence

Degradation of soils as a consequence of improper land-use management has been known for long (e.g., Sioli 1983). While our project EcoRespira-Amazon clearly focused on soil and ecosystem respiration, and soil chemistry, the project group made observations and led many discussions with stakeholders and amongst themselves that went far beyond that more narrow scope of immediate scientific endeavour. Our evaluation of satellite data from 1990 to 2015 (► 10) in comparison with our ground-truthed data from three field campaigns corroborates external work and motivates us to look at the situation in a more comprehensive manner – even though not all field data are available yet.

Hypotheses

The following hypotheses are derived from numerous informal interviews with local people, mostly farmer's families.

- Some farmers do understand that their activities are non-sustainable
- Such farmers do not want to degrade their land
- Yet, most farmers have no knowledge on how to change their practices without compromising their economic survival
- The younger generation, often with a higher educational background, mostly wishes to stay in the region
- This generation seeks answers to the described issues and wants to find solutions
- There is a critical mass in the current "immigrant" population that wishes to live and produce more sustainably
- Solutions or more precisely, distinct improvements towards more sustainable land use without compromising peoples' right to live and prosper, can be found on a local level only
- Yet, many if not most people in the region feel neglected from the politics and decision-making in the capitals
- A spirit of "every man for himself" prevails.



If we accept the additional hypothesis that only forestland is appropriate and sustainable for Amazon basin boundary conditions, then the direction to be taken must be towards the maximum preservation of this natural resource. If we accept results of acknowledged scientific studies that large-scale conventional agriculture for cash crops (independent of whether it consists of very large single farms or very many much smaller ones) can lead to quick soil impoverishment (nutrient loss, compaction, etc.) and soil loss (erosion), then we must stop this development and establish much tighter and efficient control to prevent further increase in such non-sustainable land use.

Yet there are 34 million people, who already live there, have a right to live there and the natural human wish to prosper and to further develop their region. To this respect, the Amazônia challenge is no different from other global challenges that demand human behavioural changes as prerequisite to betterment.

Pathways to solutions?

This understanding that the challenge is of major dimension and will not and cannot be met by piecemeal approaches bears the key for finding pathways to solution. There is no one single roadmap, instead there are numerous ones that could help reach the aim, since local conditions highly differ from place to place with respect to social, economic or natural conditions – the *sustainability triad*. Pathway 01: allow many and highly “individualized” solutions, try all options that have not proven false or misleading already.

Solutions or more precisely, distinct improvements towards more sustainable land use without compromising peoples’ right to live and prosper can be found on a local level only. Thus, targeting individual farms and developing better land management techniques that make use of the potential without exhausting it, is one of the necessary steps. Another step lies in fulfilling the demands of the people without necessarily allowing for business-as-usual activities. Related alternatives can be very different, non agriculture-related job opportunities or paying for the recovery of ecosystem services on a farm rather than for typical farm products. Pathway 02: Open alternatives, think out of the box, use local potential – and include indigenous experience.

Since the Amazon biome is not suited for successful long-term intensive agriculture (neither plant nor animal production), alternatives are needed next to small-scale sustainable agricultural practice. So far, the potential for the productive industrial sector is radically underexplored with Manaus being the only place with noticeable industrial production activities. Since industry, including mining, can be done on much smaller ecological footprints than agriculture, it appears worthwhile to actively pursue industrial development. However, development that does not compromise the quality of air, water and soils does not develop without clear environmental assessment studies and is following the highest standards and using best available technologies. Such a development could and would turn Amazonas into a radically different human environment. Pathway 03: Stop business as usual and explore higher levels of the value chain.

Just as the building the Transamazônica Highway was a serious challenge, involved national effort and triggered a spirit comparable to sending the first humans to the Moon, similar effort and enthusiasm is required to manage the transition from current ways of non-sustainable life in the Amazon basin to a benign and yet beneficial for-the-people lifestyle.

Such a transition cannot be brought about overnight. Yet in the next 30 years, significant steps can be made that may halt the current rate of deforestation and degradation without



forcing people away from the Basin. Obviously, this calls for a concerted action plan and full support by the Federal Government and all its ministries as well as all state governments involved with their authorities. Such a master plan demands clear priority setting and staying power – as our forefathers and foremothers have often shown. Pathway 04: Make serious and ambitious long-term plans and think from the end, not the start.

Instead of any further (half-hearted) top-down-only attempt to mitigate deterioration of the Amazon biome and to develop sustainable adaptation to the environment, we suggest an accompanied bottom-up approach. Many, if not most people in the region feel neglected from politics and decision-making in the capitals. A spirit of “every man for himself” is prevalent. Both attitudes are closely linked and potentially hinder any potentially successful move towards the aim of successful attitude change. People are suspicious of “politics” and politicians and would likely not collaborate if they feel that they are being forced by government to change.

Instead, the existing, albeit relatively weak stakeholders in the region that are willing and capable of becoming an active player in reaching the prescribed aim, should receive the capacity to work on those changes that their specific social and natural boundary conditions permit. There exist many examples of local community spirit, partly groups of immigrants from the same area or region (e.g., Northeasteners, Nordestinos or Southerners, Gaúchos). There are established bodies such as IDAM under the wings of Embrapa – and the highly respected Embrapa itself. Both Embrapa and IDAM are closely linked with local agriculturists and farmers, a promising base for developing platforms and movement for successful change at that end. Pathway 05: Appreciate local knowledge and experience, plan with the people, not above the people. They have to live there and bear consequences.

Informal and creative education tools, such as those developed by FEAM in Minas Gerais to trigger behavioural change in village communities near mine sites (Oberdá et al. 2011) can – if done with engaged and well-trained personnel – lead to rather rapid behavioural change, provided that realistic alternative options are being offered. Stakeholders must learn the necessary awareness and understanding for the issue. It is unrealistic to assume that any such positive change can develop without incentives and significant governmental investment. While this notion may appear to contradict any bottom-up approach it is not: the allocation of funding and infrastructure must not equal dominance over decisions on how money is spent and which kind of infrastructure is to be developed. It appears likely however that an existing body (such as IPAAM) or a newly created authority is needed to coordinate related efforts and to act as the interface between government with its authorities and the many local activities. Pathway 06: Transform existing institutions to provoke better collaboration, to decrease futile activism and to increase efficiency. Concerted long-term action demands concrete, concise and creative yet realistic planning, bolstering the public perception and appreciation of milestone achievements.

A coalition of state authorities with NGO's and citizen committees has the potential to trigger sustainable change, to entice people to adapt and to progress towards a much less detrimental future for the Amazon basin. Science cannot – and should not – drive this process. Science can and should monitor and analyze the changes, both from the human perspective (sociology, social psychology) and the natural perspective (ecosystem recovery and change). Pathway 07: Make sure that your plans get scrutinized and capable scientists critically evaluate all steps along the way. Do not worry about necessary course corrections along the way.



People can – and should – drive this process and be encouraged and respected in their effort. Amazonians do have the chance to find ways towards equilibrium between their Amazon biome and its demands, and their own demands. Every successful step in that direction will entice others and make Amazonians proud of their achievement – an important driver of positive development. It is not too late at all and the benefit doubtlessly is a most significant capital for Brazilian's future.

Final remark. Costa Rica, a small Latin American country, and in this respect incomparable to Brazil, has made a fascinating transition from a tendency of major forest loss towards a tendency of forest cover gain (► Figure 45). This transition goes in parallel with significant economic recovery and substantial gain (not only) in international tourism industry.

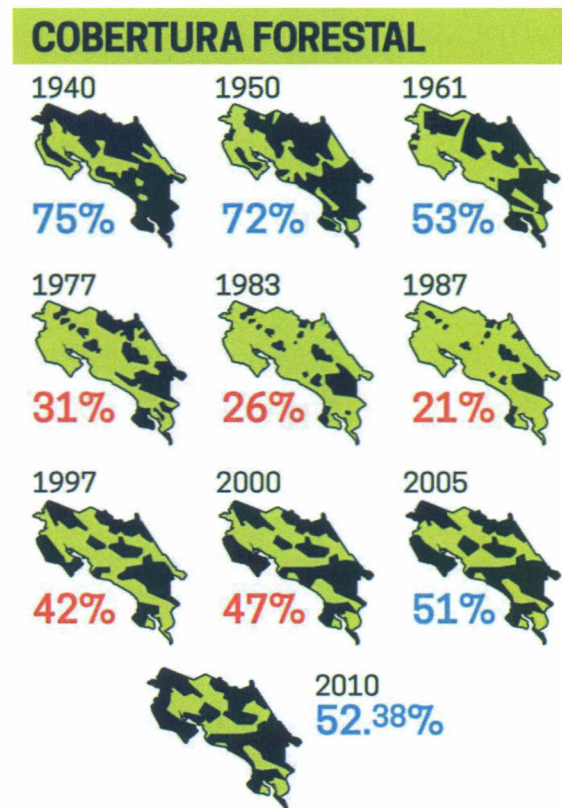


Figure 45. Costa Rica forest cover from 1940 to 2010 (personal communication by Lolita Campos)